# NAVAL POSTGRADUATE SCHOOL
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# THESIS

**CAUSE AND ANALYSIS OF COST OF LIVING ALLOWANCE FLUCTUATION IN YOKOSUKA, JAPAN**

by

William Patrick Wood

June 1996

Principal Advisor: William R. Gates

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In June 1995, an unexpected decrease in COLA index on the Kanto Plain of Japan, to include the Yokosuka area, caused concern amongst service members stationed in this area. The purchasing power of the dollar was in decline when compared to the yen and all other economic indicators at the time of the COLA decrease suggested that the COLA index should have increased or at least remained constant. What explains the apparent inconsistency between the declining value of the dollar relative to the yen and the concurrent decrease in COLA provided to service members? This thesis conducted a critical analysis of the procedures and methods used by the Per Diem, Travel and Transportation Allowance Committee (PDTATAC) to calculate the cost of living allowance (COLA) index and determine the cause and effect of the June 1995 decrease in COLA index. This thesis addressed the policies of the COLA system, utilizing both historical data and a stylized model, to determine if they are equitable from an economic standpoint. The analysis revealed that the Living Pattern Survey (LPS) was a viable tool to obtain information on where service members made purchases, if exchange rates were stable. If exchange rates were increasing, the LPS prevented overpayment of service members. If exchange rates were declining, the LPS reduced the "purchasing power" of service members.

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# CAUSE AND ANALYSIS OF COST OF LIVING ALLOWANCE FLUCTUATION IN YOKOSUKA, JAPAN

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## ABSTRACT

In June 1995, an unexpected decrease in COLA index on the Kanto Plain of Japan, to include the Yokosuka area, caused concern amongst service members stationed in this area. The purchasing power of the dollar was in decline when compared to the yen and all other economic indicators at the time of the COLA decrease suggested that the COLA index should have increased or at least remained constant. What explains the apparent inconsistency between the declining value of the dollar relative to the yen and the concurrent decrease in COLA provided to service members? This thesis conducted a critical analysis of the procedures and methods used by the Per Diem, Travel and Transportation Allowance Committee (PDTATAC) to calculate the cost of living allowance (COLA) index and determine the cause and effect of the June 1995 decrease in COLA index. This thesis addressed the policies of the COLA system, utilizing both historical data and a stylized model, to determine if they are equitable from an economic standpoint. The analysis revealed that the Living Pattern Survey (LPS) was a viable tool to obtain information on where service members made purchases, if exchange rates were stable. If exchange rates were increasing, the LPS prevented overpayment of service members. If exchange rates were declining, the LPS reduced the "purchasing power" of service members.

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# I. INTRODUCTION

## A. PURPOSE OF THIS THESIS

In June of 1995, with the dollar to yen exchange rate at an all time low 83:1, service members stationed on the Kanto Plain of Japan received an unexpected cut in the Cost-of-Living Allowance (COLA), $90 a month for the average member. This was followed by another $60 dollar a month decrease in July. Service members view COLA as a means of compensation to increase their standard of living when stationed in a high cost overseas location. Current findings in both the media and the State Department show the Tokyo area as having the most expensive economy in the world. With the decline of the dollar, service members expected their COLA to increase. Having it slashed by the Per Diem, Travel and Transportation Allowance Committee (PDTATAC) caused morale to plummet and even Flag officers to express concern just short of outrage. In July of 1995 the comptroller for Commander Naval Forces Japan (CNFJ) contacted Naval Postgraduate School and requested assistance in addressing this issue in the form of a thesis.

The topic was approached with expectation of finding a budget reduction imposed by Congress to be the cause of the COLA decrease. However, after researching the topic it was discovered that the cause of the decrease in the COLA index was a Living Pattern Survey (LPS) adjustment that had been implemented by the PDTATAC. Thus, the focus of the study shifted.

The purpose of this thesis is to determine if current policies used by PDTATAC are equitable from an economic standpoint. Issues that must be resolved in order to reach a conclusion on this matter include determining the policies and practices used in setting COLA rates, determining how the COLA rate has changed in the Yokosuka area in recent years and determining how changes in the currency

exchange rate alter the purchasing behavior of the service members. Once these questions are addressed, I will look into the effect that other economic factors may have if they are incorporated into the computation of COLA rates. In this Chapter I will define COLA and show how it is computed.

## B. COST-OF-LIVING ALLOWANCES DEFINED

The Cost-of-Living Allowance (COLA) is paid to help service members maintain purchasing power when assigned to high cost overseas areas, including Alaska and Hawaii.[1] The Per Diem, Travel and Transportation Allowance Committee (PDTATAC) administers and computes the COLA. PDTATAC has stated that they are not trying to equalize "standard-of-living" between an overseas location and duty assignment in the Continental United States (CONUS). A "standard-of-living" comparison would have to incorporate intangibles, such as crime rate and living in a close proximity to ones extended family, that do not concern PDTATAC. The COLA system compares cost for a "Market Basket" of goods and services (excluding shelter expenses) purchased in an overseas area to a similar Market Basket purchased in CONUS. The purpose of COLA is to compensate members when the cost of this Market Basket is higher in the overseas area.

The PDTATAC conducts two surveys to determine overseas prices: the Living Pattern Survey (LPS) and the Retail Price Schedule Survey (or Market Basket Survey). The LPS evaluates information from individual service members in reference to their current shopping habits, including the names and locations of local market outlets and the percentage of the market basket purchased at specific locations. In short, an LPS determines where a service member shops. An LPS is required every three years, but may be conducted more frequently on a voluntary basis. The

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[1]Author wishes to acknowledge that majority of this chapter is based on "The Joint Federal Travel Regulations, Appendix J."

LPS is conducted prior to the Market Basket Survey, in order to establish the most frequently utilized local markets for price collection. Prices are then collected in these markets, and in the commissary and exchange facilities for approximately 160 goods and services to determine how much the individual service member pays for the market basket. Average Market Basket prices are calculated by applying the percent of purchase data from the LPS to the prices obtained from the Market Basket Survey.

The Market Basket Survey is conducted annually or more frequently on a voluntary basis. Market Basket items are selected from items normally purchased by CONUS-based families that are also available in most areas overseas. Each item is assigned a weight according to its importance in the overall Market Basket based on data collected by the Bureau of Labor Statistics (BLS) for U.S. based military families in their Consumer Expenditure Survey. Prices are only collected for items that can vary between CONUS and overseas.

In summary, an LPS and Market Basket Surveys are used to compare differences in prices of items in overseas areas and the CONUS. Price comparisons determine the level of COLA needed to equalize purchasing power between CONUS-based members and their overseas counterparts.

## C. COMPUTING THE COLA INDEX

Utilizing the data from the Market Basket Survey and the LPS, PDTATAC calculates the COLA index for a specific area. The COLA index is a number that represents the Market Basket price difference for an overseas area versus the CONUS. A COLA index of 110 means that prices in the overseas area are ten percent more expensive overall than in CONUS. An index of 100 indicates that average prices in CONUS and overseas are equal and no COLA is warranted.

## 1. Mathematical Formulas for Computation of COLA Index[2]

The Market Basket Survey can be defined in mathematical terms as follows:

$$P_X^{US} * X_{US} / (P_X^{US} * X_{US} + P_Z^{US} * Z_{US}) = \text{quantity X in Market basket} = A_X, \quad 0 \leq A_X \leq 1 \tag{1.1}$$

$$P_Z^{US} * Z_{US} / (P_X^{US} * X_{US} + P_Z^{US} * Z_{US}) = \text{quantity Z in Market basket} = A_Z, \quad 0 \leq A_Z \leq 1 \tag{1.2}$$

where $P_X^{US}$ is the U.S. price of the item X, $X_{US}$ is the quantity of X item purchased in CONUS. $P_Z^{US}$ is the U.S. price of the item Z, and $Z_{US}$ is the quantity of Z item purchased in CONUS. $A_X$, and $A_Z$, are the portions of items X and Z that compose the market basket. If X and Z are the only items in the market basket, then $A_X + A_Z = 1$.

From the Living Pattern Survey the following equations were developed:

$$X_C / (X_C + X_L) = \% \text{ of X purchased in the Commissary} = B^C_X, \quad 0 \leq B^C_X \leq 1 \tag{1.3}$$

$$X_L / (X_C + X_L) = \% \text{ of X purchased on the Local Economy} = B^L_X, \quad 0 \leq B^L_X \leq 1 \tag{1.4}$$

where $X_C$ is the quantity of item X purchased at the commissary, $X_L$ is the quantity of item X purchased on the local economy and, $X_C + X_L$ is the total quantity of item X purchased overseas. Thus $B^C_X$ and $B^L_X$, are the percentages of item X purchased at the commissary and on the local economy, respectively. Thus, $B^C_X + B^L_X = 1$. In this formulation, item Z is only available at the commissary or exchange facilities. Thus the COLA index is computed by using the following formula:

---

[2]Mathematical formulas are authors interpretation of information provided in "The Joint Federal Travel Regulations, Appendix J."

$$\{[(P_X^C * B^C_X) + (P_X^{L'} * B^L_X)]/P_X^{US}\} * A_X + [P_Z^C / P_Z^{US}] * A_Z = \text{COLA Index} \quad (1.5)$$

$$P_X^{L'} = P_X^L / \text{roe} \quad (1.6)$$

Where $P_X^C$ is the price of item X in the commissary and, $P_X^C * B^C_X$ weights $P_X^C$ by the percentage of item X purchased from the commissary. $P_X^{L'}$ is the U.S. price of item X on the local economy, $P_X^{L'} * B^L_X$ weights $P_X^{L'}$ by the percentage of item X purchased on the local economy. $P_X^{US}$ is the CONUS price of item X. Thus, the term in the curved brackets represents the ratio of the weighted average foreign to U.S. price for good X. $A_X$ is the quantity of item X purchased in the average market. $P_Z^C$ is the price of item Z at the commissary. $P_Z^{US}$ is the CONUS price of item Z. Thus, $P_Z^C / P_Z^{US}$ represents the ratio of the foreign to U.S. price for good Z. Thus, $A_Z$ is the quantity of item Z purchased in the average market basket. Thus, equation 1.5 weights the foreign to U.S. price ratios for each good in the military members' market basket by the relative importance that good has in the CONUS military market basket. The U.S. price of item X on the local economy is determined in Eq. 1.6, as the yen price of item X on the local economy, $P_X^L$, divided by the yen to dollar exchange rate.

To illustrate how a COLA index is computed, the following example is taken from "The Joint Federal Travel Regulations," for the purchase of a loaf of white bread (one of the Market Basket items).

## 2. Example Computation of COLA Index

After conducting an LPS to identify the markets where service members typically purchase bread, prices for bread are collected from these markets. In this example, members purchase bread from two local grocery stores and the commissary. Local prices are converted into U.S. dollars using the prevailing rate of exchange. In this example, the foreign currency exchange rate is 2FC to the dollar. The average price of a loaf of bread in the local market is 3FC or $1.50. The commissary price for

the bread is $1.00. The LPS determines that members purchase 60 percent of their bread in the commissary and 40 percent from the local economy. The average price of a loaf of bread in the CONUS (using market and commissary bread purchases) is $0.90.

From the LPS

| | |
|---|---|
| Commissary Purchases | 60% |
| Local Market Purchases | 40% |

For the average overseas consumer

| | |
|---|---|
| Commissary Price | $1.00 |
| Local Market Price | $1.50 |
| Weighted Price = | |
| ((.60 X $1.00) + (.40 X $1.50)) | $1.20 |

COLA Index For Bread

| | |
|---|---|
| Foreign Price/U.S. Price = | |
| $1.20/$0.90 | 133 |

An index of 133 means the average price of bread is 33 percent more expensive in the overseas location than in CONUS. To compute the total COLA index for an overseas location, the same index is calculated for each of the 160 items identified in the market basket survey. The resulting indexes are weighted according to their relative importance in the Market Basket (i.e., the $A_i$'s in Eq. 1.1 & 2). For example, white bread accounts for approximately ½ of 1 percent of spending covered by the Market Basket. In general, each market basket item accounts for less than 1 percent of total spending (i.e., the $A_i$'s $< .01$ for most items). Thus, a rapid price rise

for any particular item may not significantly change the COLA. PDTATAC recognizes that some items, such as gasoline and phone services, account for approximately 4 percent of the spending for the average service member. Thus, price changes for these goods will have a more significant impact on the COLA and the service members' well being.

### 3. COLA Income Defined

Once a COLA index is determined, the member receives a COLA adjustment as a percentage of "Spendable Income," not total income. For COLA purposes, Spendable Income is that amount of an individual's Regular Military Compensation (RMC) that is used to purchase goods and services. RMC includes Basic Pay, Basic Allowance for Subsistence (BAS), Basic Allowance for Quarters (BAQ), Variable Housing Allowance (VHA) and the tax advantage associated with the tax free status of these allowances. Spendable Income differs according to a member's paygrade, years of service, and number of dependents. The Bureau of Labor Statistics (BLS) publishes data showing how U.S. families typically allocate their budgets. To determine Spendable Income Amounts, PDTATAC uses this data and subtracts the non-COLA items from a member's RMC. Non-COLA items are those items whose cost is unaffected by location, such as shelter expense (covered under Housing Allowance), income taxes, life insurance, savings, gifts and contributions. Given the same level of RMC (paygrade and years of service being equal), Spendable Income is greater for a family with more dependents. A larger family allots a greater portion of their income for items covered by COLA and will normally pay less income tax (a non-COLA item).

### 4. COLA Revisions

The COLA index is revised when foreign exchange rates fluctuate with respect to the U.S. dollar. The revision only affects those purchases made from local market

outlets as reflected in the LPS. Purchases made in U.S. dollars are not adjusted for changes in exchange rates. For most countries, the exchange rate is monitored daily. Weekly averages are computed and the COLA index can be adjusted as frequently as every pay period. The weekly average exchange rate at which service members convert their dollars into local currency is compared to the exchange rate used by PDTATAC. A computer model tracks any imbalances and changes the allowance exchange rate when the cumulative effect of all the weekly imbalances equals plus or minus ten percent of the COLA payment. The new allowance rate of exchange is selected to compensate for this imbalance over an eight week period. Because of this compensatory feature, the allowance exchange rate often differs from the rate at which service members actually trade their dollars.

The PDTATAC also recognizes that service members stationed overseas must often purchase items of significant expense (more than one percent of spendable income) that would not normally be purchased by their CONUS-based counterparts. An example would be the television tax in the United Kingdom. These expenses are reimbursed on a dollar for dollar basis with the COLA payment.

## D. YEN TO DOLLAR EXCHANGE RATE

Noting that COLA revisions are made in response to fluctuations in the foreign currency exchange rate, this section will discuss the historical exchange rate. The Japanese economy has been experiencing a mild recession for approximately five years, at the time of this writing. This analysis will focus on the dollar/yen exchange rate from 1992 to 1995. This period covers the two Living Pattern Surveys discussed in this study. For clarity of discussion, the Yen to Dollar exchange rate in this thesis refers to the monthly average number of Yen required to purchase one U.S. dollar. [Ref. 1] In January of 1992, the average exchange rate was 125 yen to the dollar (see Figure 1). It reached the high for the relevant four year period in April of 1992, at

133 yen to the dollar. In April, the exchange began a gradual decline, with the lowest monthly 1992 average coming in October at 121 yen to the dollar. In December the rate increased slightly to close out 1992 where it had begun, at 124 yen to the dollar.

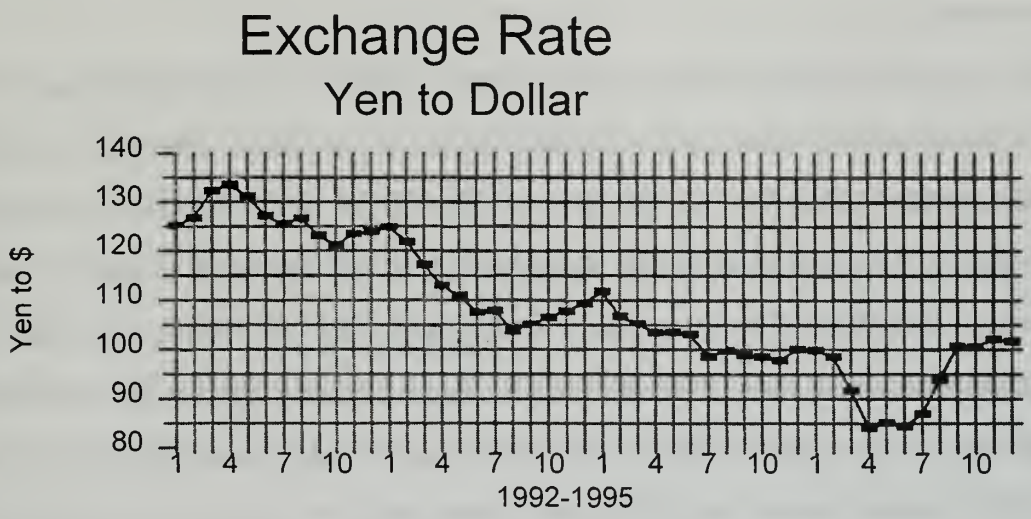



**Figure 1. Yen to Dollar Exchange Rate 1992-1995**

In February of 1993, the Yen began another gradual decline. It stabilized in June and July at 107 yen to the dollar. The average monthly low came in August at 103 yen to the dollar then the rate improved to close out December at 109 yen to the dollar. In January of 1994, the monthly average increased to 111 before entering another decline. The Yen stabilized in April and remained at 103 yen to the dollar through June. In July it dropped to 99 and remained there until November when it dropped to an annual low of 98 yen to the dollar. It improved slightly in December to close out the year at 100 yen to the dollar. In March of 1995, the Yen dropped to 91 before dropping to the post-World War II low of 84 yen to dollar in April. It improved to 93 yen per dollar in August. In September the Yen increased to 100, and was up again to 102 in November. Where it remained until the year's end.

## E. CHAPTER SUMMARY

This chapter states this thesis will examine the method that PDTATAC uses to determine the COLA index. COLA was defined as additional funds paid to a service member to help "maintain purchasing power" when assigned to high cost overseas areas.

The COLA index is based on two surveys; the LPS (which determines where the service member shops) and the Market Basket Survey (which determines the price service member's pay for specific items). The COLA index is then computed by determining the percentage of an item purchased on the local economy and at exchange facilities. This percentage is multiplied by the respective local and exchange prices of the item. These values are summed to get an average price for the item in the foreign market basket. This price is then divided by the price of the item in CONUS to determine the COLA index for the item. Revisions are made to this index as the rate of exchange changes. Recent fluctuations in the Yen to Dollar exchange rate were also discussed in this chapter.

Chapter II will discuss the Japanese economy and the factors that effect the U.S. service members. It will also contrast cultural differences between the service member and the Japanese consumer.

# II. THE ECONOMIC ENVIRONMENT

## A. CHAPTER INTRODUCTION

In order to understand the COLA issues addressed in this thesis, one must understand the environment in which these practices are being exercised. Japan now stands as a champion of the world economy. [Ref. 2] Even considering the current Japanese recession, its strong economy is the envy of all industrialized nations. Its economic growth from 1945 into the 1990s is unprecedented in all of modern history and its per capita income is the world's highest. These facts however fail to reflect the enormous social and economic burdens that are carried by the Japanese consumers. The quality of life in Japan has not kept pace with its extraordinary gains in industrial output. The Japanese people have suffered higher consumer prices, overcrowding, lack of leisure time and environmental pollution in exchange for the "economic prosperity" of their nation. This chapter will discuss aspects of the Japanese economy, the specific aspects that influence the service member and how cultural differences convolute the COLA issue.

## B. JAPAN'S UNIQUE ECONOMY

This section will address portions of the Japanese economy that have an effect on service members to include the current housing situation, the cost of consumables and the cultural differences that allow this economy to survive.

### 1. Japan's Housing Dilemma

The root of Japan's housing problem is its large population and its relatively small island land mass. Japan is inhabited by over 120 million people, which gives it a population density of 327.3 people per square kilometer as compared to 27.2 in the United States. This problem is compounded when one considers that mountainous terrain and rice paddies occupy approximately half of the land. The lack of land is

illustrated by the absence of city parks. New York City and Washington D. C. each have over 19 square meters of public park per resident; Tokyo has only 2.2 square meters per resident.

Japan's real estate prices are exorbitant. According to Karl van Wolferen, author of *The Enigma of Japanese Power*, [Ref. 3] "The total market value of Japanese land in fiscal 1987 was 4.1 times greater than that of all the land in the United States, which is twenty-five times the size of Japan and has fifty seven times more inhabitable space." Japan has an innate desire to remain independent from foreign nations as much as it is able. In order to remain self-sufficient in agriculture, tax laws discourage landowners from developing or selling their agricultural holdings. Since the early 1950's, virtually all land designated for agricultural use has remained solely for agricultural use.

Japan's housing industry is not world renowned for its quality of construction. Its pace of construction is very rapid. Within a month, an old unit is demolished and a new one is erected and completed. However, the quality of workmanship would be unacceptable by American standards. Buildings and building lots are incredibly cramped; privacy becomes more of a desire than a reality. In addition, while newly constructed homes are usually connected to sewers, those in older neighborhoods are not. Two-thirds of Japanese homes are without modern sewer systems.

Interviews with U. S. Service members reveal that common Japanese household appliances did not meet typical U.S. standards. Washers, dryers and ovens installed in their rental quarters were excessively small and performance was not up to par with comparable American products.

### 2. The Woes of the Japanese Consumer

The median salary of the average worker is approximately the same in Japan and the United States. However, the utility the Japanese consumer receives from their wages when compared to their U.S. counterparts is as different as east is from west.

Due to Japan's effort to maintain agricultural independence, food prices are inflated because of their farm price support program. Virtually every nation protects its farmers, but few to the extent and expense incurred by the Japanese. The Japanese consumer pays five times the world price for rice. The difference represents farm price supports. The OECD reports that, on average, Japan's retail prices are 70% higher than in the United States. The average Japanese citizen spends more on consumption than the average American (about $13,500 vs. $12,500 annually), yet the *Atlantic Monthly*[1] reports that one could purchase the same goods found in the average Japanese market basket in America for $7,800.

Corporate Japan has been known to sacrifice the domestic consumer to offset lower prices abroad and retain their competitive share in foreign markets. The unprecedented increase in the value of the yen to the dollar in recent years should have helped make Japanese products more expensive in the United States and American products more competitive in Japan. Instead, overall prices have remained largely unchanged. Items imported from overseas are purchased at a lower price due to the strong yen, but these savings have not been passed on to the consumer. These profits have been used to cross-subsidize prices in the overseas market and rebuild the foreign market share.

This phenomena came to a head with the "reimport scam" of 1988, in which a number of renegade retailers discovered that they could purchase Japanese made products in the United States ship them back to Japan and sell these products well below the standard Japanese price. Reimported camera film cost about half as much as the film that had never made the 15,000 mile detour to the United States. The most extreme case involved cordless phones. The reimported models sold for about one-eighth the price of those that never left Japan. Demand for these reimported phones

caused the original manufacturer to purchase the discounter's entire stock of cut-rate phones.

## C. THE DILEMMA OF THE U.S. SERVICE MEMBER

The service member receives orders and is immersed in the Japanese economy that has the highest cost of living in the world. Consumer prices are 70% higher and the amount that was spent on consumables in the United States now provides approximately half of the theoretical market basket. The cost of housing is high and the quality of housing is below par for U.S. standards. The service member relies on the COLA to increase the living standard. Unfortunately, the COLA system is not designed to be a means of sustaining a standard of living. It's purpose is more narrow.

### 1. PDTATAC's vs. the Service Member's Definition of COLA

The Per Diem, Travel and Transportation Allowance Committee states that COLA is paid to help service members maintain purchasing power when assigned to high cost overseas areas. PDTATAC recognizes that too many intangibles would have to be included to call COLA a "Standard of Living Allowance." They do not use the term when discussing COLA.

Such intangibles for Japan on the positive side include the low crime rate. Common advice given to new service members arriving in Japan is "the only place you have to lock your car is on base," and "if you are a victim of a crime in Japan the odds are high that the culprit is an American service member or dependent." The opportunity to live in an exotic location with easy access to the rest of the orient would also be a plus.

On the negative side, one would have to consider the rampant environmental pollution; overcrowded living conditions, which affect all facets of life in the Kanto Plain including housing, transportation and leisure activities; the long distances that

service members now live from their extended families; and the obvious excessive prices of the Japanese market place, as discussed previously.

It is easy for the PDTATAC to state that COLA is not a standard of living allowance while sitting at a desk in Alexandria, VA. It is a completely different issue to convey this belief to an E-5 with a family of four, living on the economy in Yokosuka.

### 2. The Impact of Higher Relative Foreign Prices

As was previously stated, this thesis adopts the premise that the standard of living in the U.S. is higher than that of Japan. For the COLA to bring the living standard of the service member in Japan up to this standard would be cost prohibitive.

One must also assume that the service member stationed in Japan will purchase a very different basket of goods than the service member stationed in the United States. As the cost of the Yen increases, the service member will tend to conduct as much business as possible at the commissary and exchange facilities that are unaffected by fluctuations in the Yen. This is not an option for the Japanese citizen. The service member will substitute items from the base facilities for items previously purchased on the local economy.

Cultural differences in the service member and the Japanese populace must also be considered. When an apple sells on the Japanese market for 500 yen, the Japanese national will consider this a fair market price and buy the apple. The service member, raised in America where fruit is inexpensive, must first consider the dollar to yen exchange ratio. Five dollars in the service member's cultural frame of reference would buy approximately four pounds of apples, not one apple. The service member maximizes utility by purchasing canned, dried or packaged fruit products from the commissary.

The example here was fruit, it could have easily been any number of items. One would be hard pressed to find a service member willing to pay $20 for a "McDonald's" meal. This substitution is a viable short term solution; under some conditions the service member is penalized for this behavior at a later time when the LPS is conducted.

## D. CHAPTER SUMMARY

Major factors that effect the service member stationed on the Kanto Plain include the cost and quality of housing, the high cost of consumables in the local market and cultural differences that affect their purchasing behavior. The difference in views of the of the definition of COLA suggests that PDTATAC sees it as a narrow purchasing power adjustment while the service members see it as more of a "standard-of-living" allowance. Chapter III contains an analysis of the impact of COLA system in practice that shows the cause of discontent among service members with the COLA.

## III. COLA FLUCTUATIONS AND ANALYSIS

### A. CHAPTER INTRODUCTION

This chapter will explore historical fluctuations in the COLA index over the last four years and analyze the causes of these fluctuations. This analysis will address revisions in the COLA index due to changes in the rate of exchange and the implementation of the February 1995 LPS.

### B. EFFECTS OF YEN RATE ON COLA INDEX

When the Cola index is plotted against the change in the currency exchange rate, the two factors show a strong negative correlation. As the exchange rate increases the COLA index decreases and vice-versa. The mirror image is not perfect (see Figure 2), deviations can be attributed to either a market basket survey, an LPS or to the computer model adjustment that is made when the cumulative effect of all the weekly imbalances equal plus or minus ten percent.

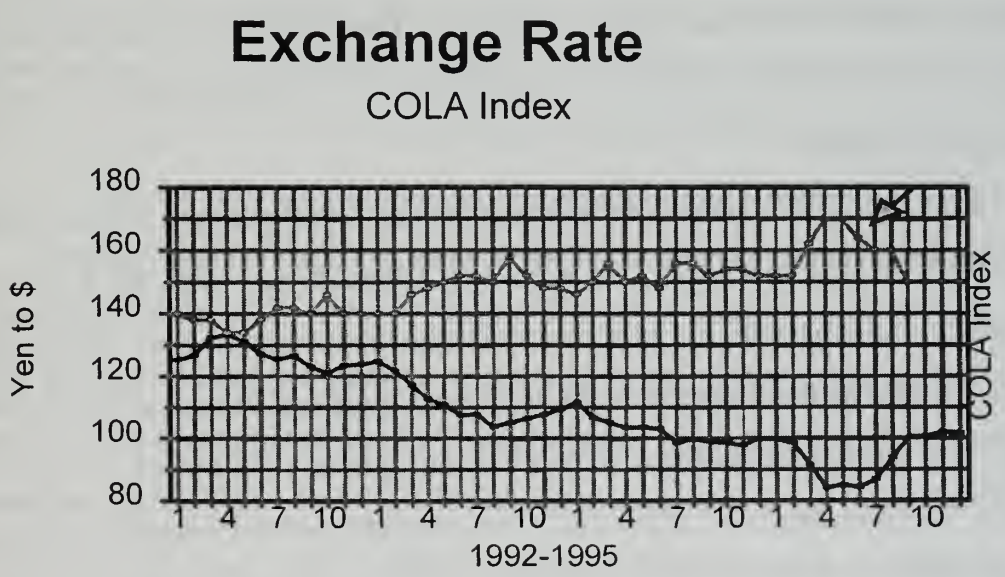



**Figure 2. COLA Index Plotted Against Currency Exchange Rate**

An example of this is observed in June 1995 when the February 1995 LPS was implemented. Because the basis for calculating the COLA index did not change, fluctuations in the prices of specific items would not have affected the COLA index. In general, each market basket item accounts for less than one percent of total spending, as discussed in Chapter I. Differences in the growth of the Japanese and U.S. economies will account for some minor COLA fluctuations due to the recession affecting the Japanese economy for this period. Since neither economy experienced an extreme inflation or depression during this period, we will consider changes in the COLA index due to differences in economic growth as insignificant.

## C. EFFECTS OF THE LPS ON COLA INDEX

Two Living Pattern Surveys were conducted in this time frame. The first was completed by service members in February of 1992, when the exchange rate averaged 127 Yen to the Dollar. It was placed in effect in June of 1992 when the exchange rate was essentially the same (128 Yen to the dollar). The second LPS was conducted in February of 1995, with average exchange rate of 99 yen to the dollar. This LPS was placed into effect in June (see arrow in Figure 2). The exchange rate had dropped to a post-World War II low of 84 yen to the dollar in April and remained in the mid eighties until August.

In the 1992 LPS, service members purchased 20.8[2] per cent of their market basket from the local market (see Figure 3 and Appendix A). With the decrease of the currency exchange rate, the local market basket dropped to 16.4 per cent in 1995. Between the two market basket surveys, mail order products increased by almost 70 percent. The market basket share in the 1992 survey was 1.8 per cent; by the 1995 survey it had increased to 3.0 percent. As expected, service members exploited exchange and commissary services more in the 1995 survey than in the 1992 survey: 80.5 and 77.4 per cent, respectively.

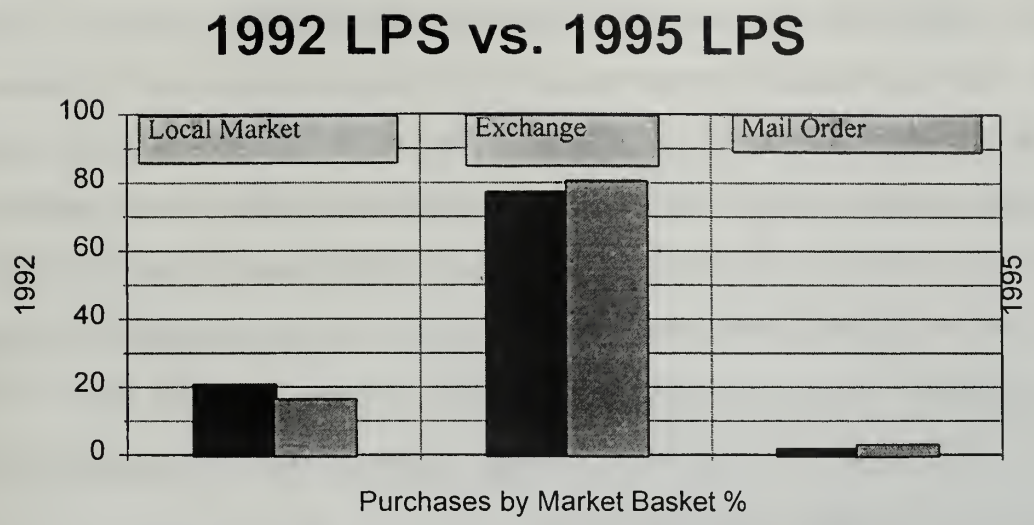



**Figure 3. 1995 LPS Plotted Against 1992 LPS Data**

In May 1995, the average COLA payment in Yokosuka was $1068 and the COLA index was 170. When the 1995 LPS was implemented in June, the COLA index dropped by 8 points. The average COLA payment decreased by $122, from $1068 to $946. This reduction occurred even though the exchange rate fell to 84 yen to the dollar. As the exchange rate increased to 105 yen to the dollar, the 31 percent increase in the power of the dollar caused the COLA index to drop another 22 points (140). This caused a decrease in COLA payments of $458 (from the 170 COLA index) to bring the average payment to the typical service member to $610.

As discussed in Chapter II, as the purchasing power of the dollar decreased in the Japanese market place, service members began purchasing more of their market basket items at exchange facilities or via mail order. Other evidence that service members sought to substitute for the more expensive local market items was provided in data from PDTATAC. In 1992, 93% of all meat purchased was fresh, the other 7% were canned products. In 1995, only 53% of meat purchases were for fresh cuts, 40% was frozen and 7% canned. Changes in fruit purchases were less dramatic but still

significant. Fresh fruit decreased from 86 % of total fruit purchases in 1992 to 76% in 1995. The ten percent difference was split evenly between canned fruit (increased from 14% to 19%) and frozen (increased from 0 to 5%). Purchases of fresh milk decreased from 96% to 92%. The four percent difference was split evenly between dried milk (increase from 4% to 6%) and evaporated milk (increased from 0 to 2%). The changes in vegetables purchases were negligible (less than a two percent change) but surprisingly, fresh juice purchases in 1995 actually increased over 1992 purchases, 33% and 24% respectively. This increase however may reflect the decrease in the purchases of fresh fruits.

## D. CHAPTER SUMMARY

In general, the revisions for changes in the rate of exchange appeared to be fair and just, as indicated by Figure 2. As predicted, when the dollar's purchasing power decreased, service members increased purchases of good and services that were not affected by the currency exchange ratio. This was reflected by the increase in exchange/commissary and mail-order purchases in the LPS. The following chapter will examine the COLA system, highlighting it's strengths and weaknesses.

# IV. A CRITICAL ANALYSIS OF THE COLA SYSTEM

This thesis will now take an in-depth look at the COLA system and the LPS. Utilizing independent reports and economic theory, the analysis will attempt to identify flaws that may exist.

## A. GAO REPORT

The General Accounting Office (GAO) conducted a bottom up review of the COLA program in 1989 and found the program to be fundamentally sound. Actions have been taken to correct all the significant program discrepancies that GAO identified. GAO noted that overseas commanders were often unaware or did not understand their responsibilities for collecting survey data. Thus quality and timeliness suffered. In response to deficiencies, the PDTATAC staff amended Appendix M "Reporting Procedures and Command Responsibilities" of the Joint Federal Travel Regulations. The Appendix established accountability for surveys with the senior officer of the uniformed services in each country.

GAO also interviewed representatives from DoD and found they support the current system and are resistant to change. The report specifically cited,

> DoD found that the present system already considers availability and therefore, is a truer measure of compensation needed to cover additional overseas costs. DoD found that the primary reason indexes decreased in Japan was that members purchased a significant amount of their fruits, vegetables and other food items at higher cost from local merchants because these products are frequently not available in commissaries. Based on past DoD visits, quality, availability, and convenience were major factors influencing local purchase decisions.... For this reason, DoD opposes changing the current basis used to determine COLA. [Ref. 6]

Therefore, as of 1989, the DoD, the GAO and PDTATAC all found the system to be sound and feasible. DoD wanted no changes made to the system and found it to be fair and equitable. Thus, knowing that the GAO found the system to be sound in 1989, the analysis will examine new flaws that may have been overlooked. These flaws have surfaced as the exchange rate decreased at a relatively steady rate from 1992 to 1995.

## B. ACTIONS TAKEN BY PDTATAC

More recently, as the rate of exchange increased and the COLA index decreased in Japan, the PDTATAC came under heavy fire from CNFJ and her subordinate commands. These commands pointed out specific problems unique to the Kanto Plain and wanted to know why there was such a sudden drop in the COLA index when the cost-of-living in the Tokyo area remained high and the dollar remained weak against the yen. PDTATAC conducted their own study of the COLA system and responded to the complaints by stating the LPS caused the decrease. The following sections summarize problems and the possible corrective actions introduced by PDTATAC.

### 1. Considerations for Corrective Measures [Ref. 7]

#### *a. Frequency of Living Pattern Surveys*

A declining dollar tends to encourage members to make more on-base purchases. This generally causes the COLA index to decrease; the price of goods and services on-base are more equivalent to prices in the Continental United States. This is the basis for the complaint that members are forced to shop on-base, becoming "prisoners of the base." PDTATAC is reviewing the LPS timing in relationship to the currency exchange ratio. If the LPS had been completed in June of 1995, when the exchange rate was 80-83 yen to the dollar, vice February of 1995 when it was 94-96

yen to the dollar, the LPS data would probably have reveled an even higher percentage of on-base purchases than shown by the current LPS.

PDTATAC recommends an annual LPS, but acknowledges that if the dollar is weak, more frequent LPS would not increase the COLA index. The purpose of doing more frequent LPS would be to avoid a drastic decrease in the COLA index that may occur over a three year period, as in the current practice.

***b. Percentage Dollar Decline to Trigger LPS***

Currently, when the dollar declines 25%, a Living Pattern Survey is requested. That policy was exercised in Japan. PDTATAC has stated that a smaller percentage should be used to avoid steep decreases in the COLA index. The current recommendation for discussion and further action is a 15% change.

***c. On-base Concession Pricing Tied to Currency Exchange Rate***

Both the market basket surveys and Living Pattern Surveys in Japan have counted goods and services purchased at on-base concessions (barber shops, gift shops, etc.) as equivalent to commissary and exchange purchases. The PDTATAC learned through subsequent visits to Japan that contracts for on-base concessions permit vendors to adjust their prices according to the dollar to yen exchange rate. This results in much higher prices than would otherwise be expected for "on-base" purchases. Thus, more of the market basket was being affected by the rate of exchange then the portion for which the service member was being compensated. In calculating COLA, PDTATAC is considering depicting concessionaire purchases as "off-base" or local market purchases. This will increase the percentage of the market basket which is affected by the rate of exchange in the computation of the COLA index.

*d. Tolls*

In Japan, most primary roads and highways are toll roads. This is one of the major complaints among service members stationed on the Kanto Plain. The cost of tolls is not currently reflected in the market basket. The difficulty in capturing toll data is assessing the average commute and average tolls incurred. PDTATAC is discussing whether tolls should be considered in transportation costs, recreation costs or portions of both. Tolls, like housing utility expenses, are items for which there is no substitute at the commissary or exchange facilities.

*e. Housing Utility Expenses*

In most overseas locations, the average utility allowance for members residing on the economy does not permit members to live comfortably. With the previously stated difference in housing standards between Japan and the U.S. (e.g., lack of insulation, lack of central heat and/or air conditioning, lack of wattage power sources), it is difficult to capture the "real" cost of comfort. For example, due to the high cost of utilities members stationed overseas tend to conserve energy to a point that would be considered extreme by their peers stationed in CONUS. This behavior continues to depress the "average" living cost.

In Japan there is a special consideration. Members residing on the Japanese economy must submit their utility receipts so that the U.S. government can be reimbursed for the housing utilities by the Japanese Government. The service members are not reimbursed by the U.S. government. This provides little incentive for the members to submit their utility bills when they receive no benefit from the reimbursement of utilities. The PDTATAC has proposed funneling the utility reimbursements down from the U.S. Treasury to the members actually incurring the expenses and setting a utility allowance at the 80th percentile. This would significantly increase the COLA payment of those service members who are most dependent

on the system (those living on the local economy), without affecting the overall COLA index. The proposed policy is consistent with the policy already established for housing rentals. This change will require approval and funding by the Services.

*f. How and When to Make COLA Adjustments*

Currently portions of the COLA attributed to purchases in yen are tracked daily, averaged weekly, and can be adjusted as often as every pay day. According to the current COLA model, whenever the cumulative dollar to yen exchange rate changes plus or minus ten percent, the COLA index is adjusted. This may be acceptable for small discretionary COLA purchases, but may be too infrequent for higher priced items, such as utility expenses. PDTATAC is currently examining two options: service members could be paid utility allowances in local currency (yen); alternatively, the monthly COLA index could be set according to the exchange rate for a specified date of the month; the difference, if any, could be made up the following month. For the latter alternative to work, service members must know the specific date they can buy their yen for high expense items. As with most of the other suggestions, the Services will need to approve and fund these options.

*g. Education*

There is no doubt that the COLA program is not readily understood. The PDTATAC is developing a simplified brochure and a video tape for distribution to overseas locations. They encourage the overseas chain of command to develop their own theater specific education package. PDTATAC believes that this is a large portion of the problems concerning the COLA.

We have seen the issues raised by service members and addressed by PDTATAC, with their considered corrective measures. The next section will reanalyze the COLA system from a different perspective in order to shed new light on problem areas.

## C. ANALYSIS OF THE LPS

Although the GAO, DoD and PDTATAC all found the COLA system to be sound, when analyzed using economics theory, flaws can be identified in the system. This issue has not been raised in the past because, unless conditions reach an extreme, the system will function as designed. This theory states that a constant decline in the rate of exchange coupled with a periodic LPS will send the COLA index into a downward spiral.

### 1. The Utility Theory [Ref. 8]

To motivate the discussion in the following sections, this section will briefly define utility theory. When a consumer is confronted with several market baskets from which to choose, the consumer will compare the *utility* provided by each basket. Utility indicates the level of enjoyment or satisfaction the consumer receives from each market basket. The market baskets contain a variety of items, none of which are exclusive to a particular basket. As the items differ in each basket, so does the cost and utility. The consumer wants to maximize his or her utility (receive as much enjoyment possible) from his or her market basket. Constraints on the maximized utility are imposed by commodity prices and consumer income. The next section will incorporate the utility theory into the COLA system.

### 2. COLA and the Utility Theory

As discussed in Chapter II, as the strength of the dollar decreases against the yen, service members will strive to maximize their utility by substituting items bought in the commissary for items previously purchased on the local economy. The lower the dollar goes the more the consumer substitutes items from the commissary for items on the local market in the market basket.

This behavior will increase the service member's standard of living in the short run. But, over time, the PDTATAC Living Pattern Surveys will show that service

members are purchasing less of their goods and services from the Japanese economy; the COLA index will correspondingly decrease. The service member then has less money with which to maintain the previous living standard. If the dollar continues to decline, the COLA program will lock itself into a downward spiral. The more the service member tries to maximize utility the less resources one will receive, until the service member is forced to become a prisoner of the commissary and exchange facilities, or the rate of exchange increases or stabilizes.

### 3. The LPS Defined as a Utility Function

In order to analyze the effects that fluctuations in the exchange rate have on consumer utility, the following stylized model was created. The model illustrates how the LPS affects consumers when the rate of exchange changes and all other factors are held constant. Consumer utility is measured by their "purchasing power." After the rate of exchange and LPS have been implemented the consumer will adjust the quantity and combination of exchange and local economy goods they purchase based on the new income constraint. The following utility function was created to predict the effect the LPS would have on consumer behavior. For reasons of simplicity, the utility function will limit the market basket to three items.

#### *a. The Model Defined*

In constructing a model to predict the expected out comes we will define Utility (U) as:

$$U = 3\ X_C^{.33}\ X_L^{.33}\ Z_C^{.33} \qquad (3.1)$$

where $X_C$ is the quantity of good X purchased at the commissary, $X_L$ is the quantity of good X purchased on the local economy, and $Z_C$ is the quantity of an alternative good that may be substituted for X, but is only available in the commissary.

The Price (P) of the above stated items will be defined as follows:

$$P_C^Z = P_{US}^Z \tag{3.2}$$

$$P_C^X = P_{US}^X \tag{3.3}$$

$$P_L^X / r = P_L^{X'} \tag{3.4}$$

Eq. 3.2 states that the price of market item Z in the commissary equals the price of market item Z in the United States. Eq. 3.3 states the price of market item X in the commissary equals the price of market item X in the United States. Eq. 3.4 states the yen price of item X on the local economy divided by the current yen to dollar exchange rate equals the dollar price of item X on the local economy.

As explained in Chapter I, the COLA index for good X is defined in the in the following equation:

$$R = \{P_C^X[X_C / X_C+X_L] + P_L^{X'}[X_L / X_C+X_L]\} / P_{US}^X \tag{3.5}$$

where $X_C/(X_C+X_L)$ determines the percentage of item X purchased at the commissary, $X_L/(X_C+X_L)$ determines the percentage of item X purchased on the local economy and $P_{US}^X$ is the price of item X in the United States. According to the assumptions listed above, the COLA index for good Z is 1 ($P_C^Z = P_{US}^Z$). The weighted COLA index depends in part on the relative quantities of good X and Z in the consumers' market basket, which is reflected by the market basket survey. If the typical market basket contains 50% of good X and 50% of good Z, the weighted COLA index is from Eq. 1.5:

$$\{[(P_X^C * B^C{}_X) + (P_X^{L'} * B^L{}_X)]/P_X^{US}\} * 0.5 + \{P_Z^C / P_Z^{US}\} * 0.5 = \text{COLA Index.}$$

Thus, utility is used in the illustrative model (see Appendix B).

## 4. Results of the Model

The model demonstrates that as $P_L^{X'}$ increases due to a decrease in r, while $P_C^X$ and $P_c^z$ remain constant, service members will maximize their utility by substituting $Z_C$ and $X_C$ for item $X_L$. As the price of the local items increase (decrease) over time, the consumer continues to substitute either $Z_C$ or $X_C$ for $X_L$ (or vice-versa), and utility continues to decrease ( increase).

The model was run with 48 months of historical data to ensure that the COLA adjustment calculated in the model was consistent with historical patterns. The LPS, market basket survey and COLA index calculated in the model were validated by comparing actual data to the model's output (see Appendix B).

### *a. Constant Decrease in Rate of Exchange*

Assuming a constantly decreasing exchange rate, the model was run with an annual LPS revision to the COLA index, a three year LPS revision and no LPS revision, to determine the effect that this would have on consumer behavior. Under all conditions the purchase of local items decreased, as expected. Utility also decreased in the annual and the three year LPS Case (see Figure 4 and Appendix B). In the no LPS case utility initially decreases, and then inverses. Without an LPS to adjust the weights on the local and commissary prices, the COLA index simply reflects the change in exchange rates. With constant weights on local and commissary prices, the COLA index increases to the point where the utility maximizing consumer is actually better off as the exchange rates fall. The consumer is actually substituting cheaper commissary goods for more expensive local goods, but this change in consumption pattern is not reflected in the COLA index.

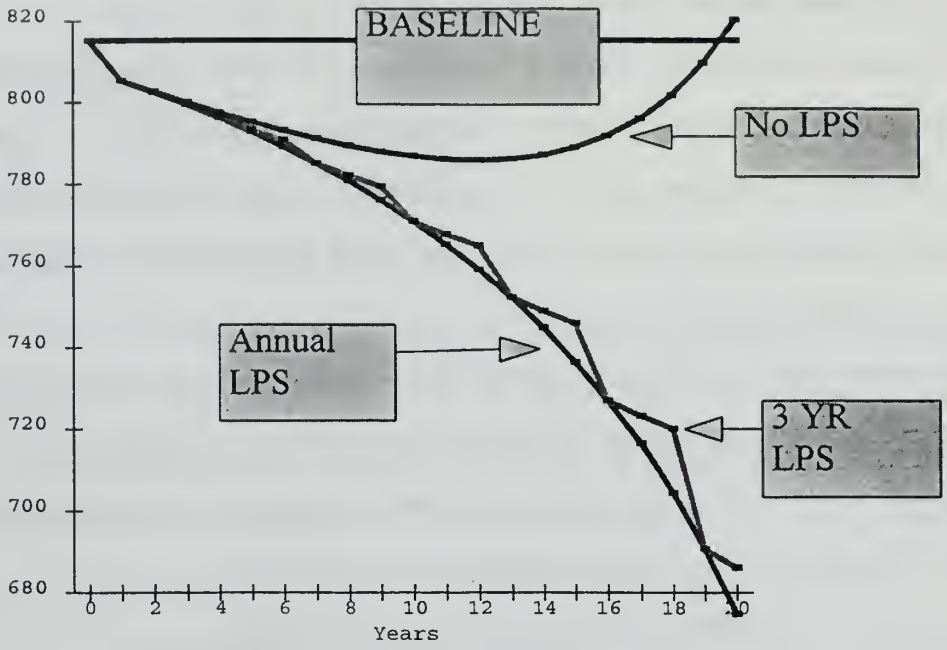



**Figure 4. Model Run with Constant Decrease in the Rate of Exchange**

Utility decreased at a constantly increasing rate in the annual LPS run. The three year LPS run showed a more sporadic pattern, in which utility decreased more slowly between LPS, and more rapidly in years when an LPS was conducted. In deciding between an annual or a periodic LPS, policy makers must choose between a steady or more sporadic adjustment path. The net result will be the same in either case.

When the model was run with No LPS, the consumers slowed the decrease of utility by making more commissary purchases. As explained above, they actually increased utility above baseline at the 20 year point through this behavior. At the ten year point utility had diminished significantly less than with either the annual or three year LPS. These changes in purchasing patterns are consistent with the historical data that was provided by PDTATAC, which was discussed in Chapter

III. Thus, as the rate of exchange continues to decrease, a downward spiral of the COLA index will occur.

### *b. Constant Increase in Rate of Exchange*

The model was run under the same three conditions as stated above with a constant increase in the rate of exchange. As expected, utility increased in all cases (see Figure 5). The increase in utility was achieved by consumers substituting commissary goods with the less expensive local items as the rate of exchange increased. Utility rose the fastest in the No LPS run. As was demonstrated in the decreasing runs, consumers maximized utility under the three year run until they were placed in check by the LPS. Utility increased at the slowest rate with an annual LPS.

### *c. Cyclic Changes in the Rate of Exchange*

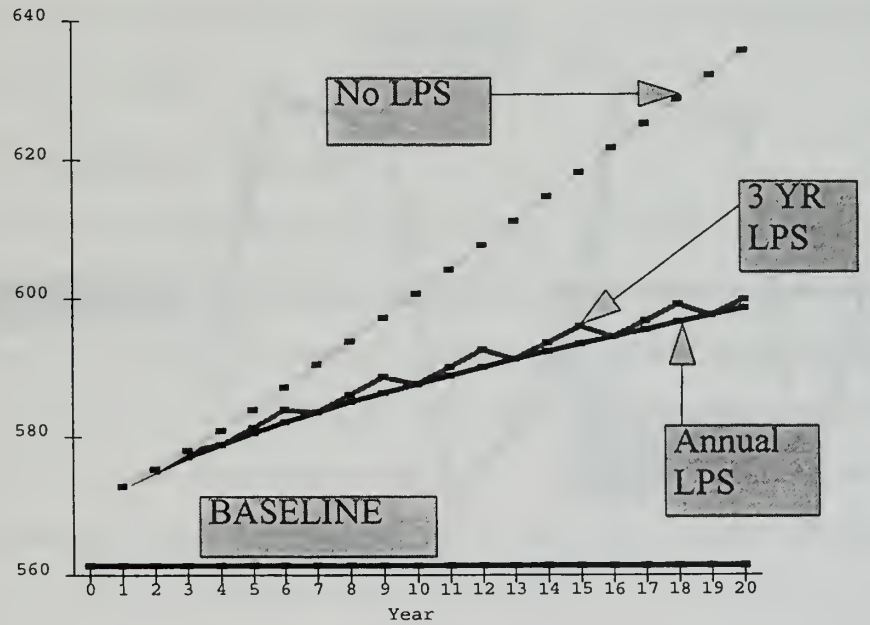



**Figure 5. Model Run with Constant Increase in the Rate of Exchange**

The model was then run to look at the various effects that conducting the LPS would have, given a cyclic trend where the rate of exchange varied up and down (see Figure 6. Note: only the two extreme most cases appear on graph). Conditions included LPS being conducted annually, at three year periods in peaks and troughs of the rate of exchange, at three year periods at the median exchange rate, on peak years with a delay of one year implementation, and No LPS. The cyclic approach showed the expected trends of substitution, when the dollar was strong consumers purchased more of the local goods and when the dollar was weak they substituted the local items. Under all conditions, utility fluctuated with the rate of exchange. The frequency of the LPS had no significant effect on utility when the rate of exchange was stable or cyclic.

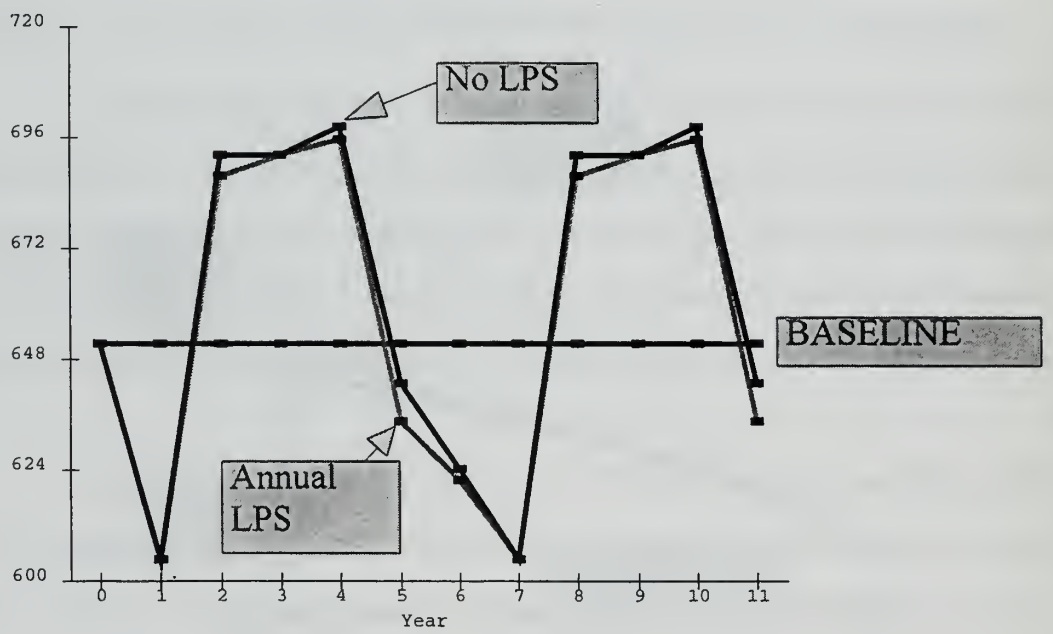



**Figure 6.** Model run with Cyclic Rate of Exchange

Thus, unless the rate of exchange is decreasing or increasing over a significant period of time the LPS has little effect on the utility of the consumer.

When implemented in both cases of an increasing or declining rate of exchange, it diminishes the consumers utility.

## D. ADMINISTRATIVE ISSUES

As one reviews the literature, the obvious cause of discontent of CNFJ and her subordinate commands was implementing the 1995 Living Pattern Survey when the dollar remained at an all time low against the yen. As the service members were struggling to deal with the devalued dollar, PDTATAC reduced the COLA index by following standard procedure and implementing the LPS. Initiating this procedure when the dollar/yen exchange rate was relatively stable, would likely have generated much less heart ache amongst the service members stationed on the Kanto Plain. This could have occurred if the 1995 LPS implementation were delayed until November. PDTATAC should examine it's own strategy and identify their customer. If their primary responsibility is to the service member, they should make procedure changes as painless as possible.

## E. CHAPTER SUMMARY

GAO concluded that all parties involved found the COLA system to be fair and equitable as of 1989; PDTATAC has taken action to correct flaws that have been brought to it's attention by concerned parties. The actions taken will not correct the problem of the LPS. Most issues that were addressed either dealt with including new information or items in the market basket survey (On-base concessions and tolls) or rate of exchange issues ( utility expenses, currency adjustments). The considerations that were made for changes to the LPS (frequency of LPS and percentage dollar decline) do not address the real problems associated with the LPS.

The model showed that even when the LPS is conducted on an annual basis, or in response to a percentage change in the exchange rate consumers will not be inhibited from substituting items on the local economy for cheaper commissary

goods. The model revealed that when an LPS was conducted and implemented at a time when the rate of exchange was decreasing it was counter productive to the purpose of COLA system, preserving purchasing power. Conducting the LPS at this time decreases the "purchasing power" of the service member, and if the dollar continues to lose value, the a downward spiral of the system will occur. However, if conducted and implemented at a time when the rate of exchange is increasing, it prevents "over payment" to the service members. When the economy of is stable or cyclic the LPS has no significant effect on the consumers utility.

In addressing the issue of a downward spiral in the COLA system caused by service members striving to maximize their utility as the rate of exchange continues to decrease, we have uncovered the root of the problem with the LPS. The theory has been supported both by the data provided by PDTATAC and in the model developed. The model also showed that when the economy was stable, or cyclic, the system would function properly. We concluded the chapter by discussing when to incorporate the data from the LPS into the COLA index. The thesis will draw conclusions and make recommendations in Chapter V.

# V. RECOMMENDATIONS AND CONCLUSIONS

## A. CHAPTER INTRODUCTION

As revealed in Figure 2, the primary driver of the COLA index is the rate of exchange. However, the COLA index, and hence service members' purchasing power is also affected by the LPS. In fact, the LPS always diminishes utility through its effect on the COLA index. As seen in Figure 4, utility decreases as the yen to dollar exchange rate decreases; the LPS further penalizes consumers as they substitute commissary goods for relatively more expensive items previously purchased on the local market. As the yen to dollar rate of exchange increases, consumers will substitute relatively cheaper local items for commissary goods. The LPS again decreases utility by penalizing the consumer for this substitution. As seen in figure 5, utility increases as the exchange rate increases under all conditions; but the rate of increase is significantly reduced with an LPS adjusted COLA.

In summary, the existing data and the model provided in Chapter IV support the theory that under the current system, when the rate of exchange continues to decrease or increase, decisions to maximize one's utility in the short run can penalize one's resources in the long run if the LPS is used to adjust the COLA index. Recommendations for a more economically rational system will follow. In closing, areas for further research are recommended.

## B. RECOMMENDATIONS

Reviewing the data compiled in Chapter III and PDTATAC's recommendation stated in Chapter II, suggests several modifications to help correct the COLA adjustment problem and/or lessen the service member's frustration. These recommendations will address the LPS specifically and then address the issues of timing and education as an answer to the problem.

### 1. The LPS

In 1995, the center of controversy in the Kanto Plain was a COLA decrease caused by the LPS. There were no complaints concerning the fluctuation in the COLA index due to the currency exchange rate. There are at least two policies that would preclude repeating this controversy: making the LPS sensitive to economic conditions and terminating the LPS.

#### *a. Make the LPS Sensitive to Economic Conditions*

Instead of conducting the LPS at a predetermined interval (i.e., every three years) as is the current practice, the LPS should be dictated by economic conditions; discontinue the LPS when exchange rates are declining. If the rate of exchange is stable or fluctuating then conducting an LPS would not significantly affect the COLA index or consumers' utility (see Figure 6). It would simply validate the Market Basket that PDTATAC is using to compute the COLA index. In this environment, the LPS basically completes the task for which it is designed: determining where the service member shops.

If the rate of exchange is increasing substantially (i.e., 15%), an LPS should be conducted to prevent over compensating service members for cost of living differences. This was demonstrated in the model (see Figure 5).

However, if the rate of exchange is on a steady decline, conducting an LPS would be counter productive. The COLA was established to increase the "purchasing power" of service members stationed in high cost overseas areas. As service members strive to maintain utility by substitution in the face of increasing local prices, the LPS further reduces their utility (purchasing power) (see Figure 4).

#### *b. Establish an Average Market Basket and Terminate LPS*

Another option to avoid the 1995 controversy would be to simply eliminate the Living Pattern Survey. The PDTATAC could establish an average

market basket for a specific overseas location, and simply adjust the COLA for changes in the exchange rate. Utilizing data collected over the years from previous LPS and correcting for the exchange rate at the time of the LPS, one can could determine if there is relative stability in service members shopping behavior. If an average market basket could be established and shown to be stable, the LPS could be completely discontinued without significantly affecting the COLA, or completed over longer time year intervals on a smaller scale to insure there is no significant deviation from the norm.

Under this alternative, service members' economic behavior would allow them to increase their utility by substituting local for exchange goods, or vice-versa, as the rate of exchange fluctuated widely, with no long run penalty for this behavior. If exchange rates were generally declining, this would allow service members to offset some of their utility and purchasing power losses; if exchange rates were generally increasing, service members could increase their existing utility. If the service member chose not to substitute items from the local economy with goods from the exchange facilities, due to inconvenience (e.g., member lives on local economy) or lifestyles (e.g., prefers fresh fruit no matter what the price), this service member would not be penalized by local price changes and adjustment in the representative market basket. In addition, funds used for the routine LPS would be saved.

*c. Factor for Substitution*

To save administrative costs, the LPS could also be replaced by a economic based COLA adjustment. The yen to dollar exchange rate dropped approximately 22% between the 1992 LPS (127) and the 1995 LPS (98). The 1995 Living Pattern Survey showed a 4.4% decrease in purchases on the local economy for the same time period. For reasons of discussion, assume that 127 yen to the dollar is the average long term exchange rate. These figures suggest that as the rate of

exchange decreases, typical consumption patterns will shift from the local market to exchange facilities and mail order shopping; the rate of shift is approximately 1% for every 5% that the dollar weakens. This factor could be used to correct for service members' substitution effect. One would expect just the opposite effect if the dollar rises in value. For every 5% that the dollar increases against the yen, one would expect service members to shift 1% of their purchases back to the local economy.

This factor would be a means for adjusting the COLA during wide fluctuations in the rate of exchange. While this would eliminate the expense to conduct an LPS, it would not eliminate the controversy surrounding the LPS: any purchasing pattern based COLA adjustment will further reduce service members' purchasing power when exchange rates are falling. This result is true whether the adjustment is based on an LPS or administrative rule.

**2. Timing of Policy Changes**

If the COLA continues to be adjusted based on the LPS, there are modifications which can soften the short run effects on service members. When one considers the amount of the decrease in the COLA index due to the 1995 Living Pattern Survey (an eight-point drop), and the large time period between scheduled LPSs (three years), it would have been relatively easy for the PDTATAC to smooth the decrease over a longer period of time. For example, decrease the COLA Index by two points over a four month period. The concern of overpayment to service members during the adjustment process could be corrected by either ignoring small fluctuations in the exchange rate or continuing to decrease the COLA index after the exchange rates have stabilized. This cap in monthly adjustment is similar to a variable rate mortgage, in which percentage of interest charged can only fluctuate by two percent each year. To compensate for under-adjustment, variable rate mortgages

use negative amortization (i.e., increase the loan period). COLA adjustments could adopt similar schemes.

Another option would be delaying the implementation of the LPS if the rate of exchange has dropped significantly since the survey was conducted. At this new low for the rate of exchange, the survey would be invalid and implementation would only decrease the service members' utility. The LPS could be implemented when the rate of exchange swings back to a more stable state.

These procedures may not be necessary if the current exchange rate is stable. However, a large part of the discontent with the 1995 adjustment in the COLA index reflected the all time low of the dollar to the yen exchange rate at the time of implementation. Service members were adjusting to the lower exchange rate when the COLA was further decreased. Had the dollar been stronger at the time of implementation, the effects of the LPS decrease would have likely gone unnoticed.

### 3. Education of Service Members on Economic Impact of Behavior

The PDTATAC stated that education of the service member was a primary cause of frustration with the system. The fact that service members do not understand the COLA system does not make it impossible for members to maximize their utility. The individual service members substitute between the local and exchange facility goods to maximize utility. The service members are making the most efficient use of their resources to achieve the maximum benefit. Under the current system, the increase in utility that the service member enjoys after making these substitutions are in part only a short term benefit. Once data is collected from the new LPS, this substitution causes the entire group to lose a significant portion of their COLA resources. The assumption that when the service members receive this information they will change their behavior is at best naive.

Unfortunately, individual rationality indicates that service members will continue to make these substitutions despite the adverse potential long run implications. It might be optimal in the aggregate for service members to individually limit their substitutions, to avoid future reductions in the COLA index. However, it is unlikely that service members will individually limit their substitutions. The individual service member captures all of the benefits of switching away from increasingly expensive local market goods. Unfortunately, the costs of these substitutions in terms of a lower COLA index are spread over the entire group of service members stationed in Japan. Thus, individual members capture all the benefits of their substitution but only bear a fraction of the costs. Thus, individual decision makers are likely to continue to make substitutions despite the potential adverse long run aggregate inputs.

Because of this individual rationality, individual service members cannot be expected to consider the best long run interest of the aggregate population. If any action is to be taken to address this problem, it must address the frustration associated with the COLA system due to ignorance. It will probably not affect the behavior of the individual service member. It is the opinion of the author that funding for education will go to waste. PDTATAC should abandon this option.

## C. SUMMARY

In closing, GAO's findings that the Cost of Living Allowance system is a sound and viable system is a true statement as long as the exchange rate is cyclic or stable. When the exchange rates of the overseas location encounters extremes, such as a significant decrease in the rate of exchange over the extended period, the system will enter a downward spiral. Service members striving to maximize their utility will show significant purchasing pattern shifts in the LPS. As long as the yen to dollar rate remains stable, the current COLA system will function adequately without any

of the recommendations that have been made in this thesis. COLA in Japan is a thorny issue simply due to Japan's unique economy and culture. The importance of the U.S. presence in the Pacific Rim makes good relations with Japan vital to our National Security. Thus, the morale of service members stationed on the Kanto Plain is vital. For these reasons I would request that the PDTATAC consider and implement the suggestions made in this thesis, including the changes that they have identified. Making the LPS sensitive to economic conditions is clearly the most viable solution to prevent the type of controversy experienced in 1995. In other words, discontinue the LPS when exchange rates are following a downward trend. Since the primary driver of the COLA index is the rate of exchange, terminating the LPS maybe the more logical option.

Continued research should be conducted to either refute or support the findings of this thesis. Suggested endeavors would include a follow-up research on the Kanto Plain to discover if service members' behavior holds true to these findings during future fluctuations in the dollar to yen exchange rate. Long term data should be compiled to ensure that this is not a cyclic or seasonal phenomena. Comparative studies of other overseas locations with similar circumstances to those found in Japan would also be useful in either supporting or refuting these findings.

Expanding the stylized model constructed in this thesis to include items on the local market for which there is no valid substitute (i.e., tolls or utility expenses) is also a recommended option for further research. Future research should also consider the U.S. based market basket used in the COLA calculations (i.e., is the $A_I$s in the COLA model). The further relative prices in Japan vary from prices in the U.S., the further the optimal basket in Japan varies from the optimal basket in the U.S. Thus, the U.S. market basket may not represent what service members purchase overseas. The current analysis does not capture this aspect of the COLA system.

## APPENDIX A. 1995 LPS AND 1992 LPS DATA

| ITEM | % LOCAL MARKET | | % COMM/ PX | | % MAIL ORDERED | |
|---|---|---|---|---|---|---|
| | 1995 | 1992 | 1995 | 1992 | 1995 | 1992 |
| BEEF & VEAL | 16 | 15 | 84 | 85 | 0 | 0 |
| PORK | 16 | 19 | 84 | 81 | 0 | 0 |
| LAMB/OTHER | 14 | 15 | 86 | 85 | 0 | 0 |
| FISH | 44 | 59 | 56 | 41 | 0 | 0 |
| POULTRY | 18 | 21 | 82 | 79 | 0 | 0 |
| CAN MEAT/FISH | 15 | 17 | 85 | 83 | 0 | 0 |
| EGGS | 22 | 30 | 78 | 70 | 0 | 0 |
| FATS & OILS | 8 | 11 | 92 | 89 | 0 | 0 |
| MILK/ICE CREAM | 18 | 25 | 82 | 75 | 0 | 0 |
| CHEESE | 8 | 10 | 92 | 90 | 0 | 0 |
| MILK DRIED | 5 | 10 | 95 | 90 | 0 | 0 |
| BREAD | 30 | 40 | 70 | 60 | 0 | 0 |
| FLOUR & MIXES | 8 | 14 | 92 | 86 | 0 | 0 |
| CEREALS | 5 | 6 | 95 | 94 | 0 | 0 |
| RICE /PASTA | 15 | 26 | 85 | 74 | 0 | 0 |
| COFFEE / TEA | 16 | 20 | 84 | 80 | 0 | 0 |
| SOFT DRINKS | 20 | 16 | 80 | 84 | 0 | 0 |
| SUGAR / CANDY | 16 | 7 | 84 | 93 | 0 | 0 |
| BABY FOOD | 7 | 7 | 93 | 93 | 0 | 0 |

| | | | | | | |
|---|---|---|---|---|---|---|
| FRESH FRUIT | 44 | 56 | 56 | 44 | 0 | 0 |
| CAN FRUIT | 8 | 9 | 92 | 91 | 0 | 0 |
| FRESH VEG | 45 | 57 | 55 | 43 | 0 | 0 |
| CAN VEG | 4 | 9 | 96 | 91 | 0 | 0 |
| FRZ VEG/FRUIT | 7 | 9 | 93 | 91 | 0 | 0 |
| DETRG/CLEANSER | 8 | 11 | 90 | 89 | 2 | 0 |
| TOILETRIES | 9 | 12 | 91 | 88 | 0 | 0 |
| PAPER PRODUCTS | 12 | 14 | 88 | 86 | 0 | 0 |
| HSEHLD FURN | 24 | 22 | 76 | 78 | 0 | 0 |
| HSEHLD APPL | 18 | 18 | 82 | 82 | 0 | 0 |
| MEN'S CLOTHES | 15 | 34 | 61 | 59 | 24 | 7 |
| WOMEN'S CLOTHES | 18 | 29 | 53 | 51 | 29 | 20 |
| CHILDRN'S CLOTHES | 18 | 26 | 61 | 55 | 21 | 19 |
| PHOTO SUPPLIES | 13 | 20 | 76 | 76 | 11 | 4 |
| READING MATERIAL | 15 | 14 | 69 | 75 | 16 | 11 |
| AVERAGE | 16.44 | 20.82 | 80.53 | 77.38 | 3.03 | 1.79 |

# APPENDIX B. STYLIZED MODEL OF COLA SYSTEM AND RESULTS

# DECLINING RATE OF EXCHANGE

Model/Assumptions

U = 3(Xc^ß)(X1^μ)(Zc^$)
Pc,z = Pus,z = 1
Pc,x = Pus,x
P1,x/r = P1,x'
at t = 0, P1,x' = Pc,x = Pus,x
(Pus,z)(Qus,z)/Ius = ß = 1/2
(Pus,x)(Qus,x)/Ius = (1 - ß) = 1/2
If,t = Rt-1*Ius,o
R = {[Pc,x*(Xc/(Xc + X1) + P1,x'*(X1/(Xc + X1)]/Pz,uc}^0.5 + Pz,c^0.5

| ß | μ | $ | r | Ær | Pus,z | P1,z | ß | (1 -ß | Io |
|---|---|---|---|---|---|---|---|---|---|
| 0.33 | 0.33 | 0.33 | 140 | -5 | 1 | 250 | 0.5 | 0.5 | 1200 |

Annual LPS/Declining Exchange Rate

| Year | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| It | 1200 | 1200 | 1211 | 1222 | 1234 | 1246 | 1259 | 1272 | 1286 | 1300 | 1315 | 1330 | 1347 | 1364 | 1381 | 1400 | 1420 | 1440 | 1462 | 1484 | 1508 |
| Xc,t | 224 | 224 | 226 | 228 | 230 | 233 | 235 | 237 | 240 | 243 | 245 | 248 | 251 | 255 | 258 | 261 | 265 | 269 | 273 | 277 | 282 |
| X1,t | 224 | 216 | 210 | 204 | 197 | 191 | 185 | 178 | 171 | 165 | 158 | 151 | 144 | 136 | 129 | 121 | 114 | 106 | 97.4 | 89.1 | 80.4 |
| Zc,t | 400 | 400 | 404 | 407 | 411 | 415 | 420 | 424 | 429 | 433 | 438 | 443 | 449 | 455 | 460 | 467 | 473 | 480 | 487 | 495 | 503 |
| LPSc | 0.5 | 0.51 | 0.52 | 0.53 | 0.54 | 0.55 | 0.56 | 0.57 | 0.58 | 0.6 | 0.61 | 0.62 | 0.64 | 0.65 | 0.67 | 0.68 | 0.7 | 0.72 | 0.74 | 0.76 | 0.78 |
| r,t | 140 | 135 | 130 | 125 | 120 | 115 | 110 | 105 | 100 | 95 | 90 | 85 | 80 | 75 | 70 | 65 | 60 | 55 | 50 | 45 | 40 |
| Pc,x,t | 1.79 | 1.79 | 1.79 | 1.79 | 1.79 | 1.79 | 1.79 | 1.79 | 1.79 | 1.79 | 1.79 | 1.79 | 1.79 | 1.79 | 1.79 | 1.79 | 1.79 | 1.79 | 1.79 | 1.79 | 1.79 |
| P1,z,t' | 1.79 | 1.85 | 1.92 | 2 | 2.08 | 2.17 | 2.27 | 2.38 | 2.5 | 2.63 | 2.78 | 2.94 | 3.13 | 3.33 | 3.57 | 3.85 | 4.17 | 4.55 | 5 | 5.56 | 6.25 |
| Pc,z,t | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Rt | 1 | 1.01 | 1.02 | 1.03 | 1.04 | 1.05 | 1.06 | 1.07 | 1.08 | 1.1 | 1.11 | 1.12 | 1.14 | 1.15 | 1.17 | 1.18 | 1.2 | 1.22 | 1.24 | 1.26 | 1.28 |
| Ut | 815 | 805 | 803 | 800 | 796 | 793 | 789 | 785 | 781 | 776 | 771 | 765 | 759 | 752 | 745 | 737 | 727 | 717 | 705 | 691 | 675 |

3 Year LPS/Declining Exchange Rate

| Year | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| It | 1200 | 1200 | 1211 | 1223 | 1234 | 1247 | 1262 | 1272 | 1288 | 1306 | 1315 | 1335 | 1357 | 1364 | 1389 | 1418 | 1420 | 1454 | 1494 | 1484 | 1533 |
| Xc,t | 224 | 224 | 226 | 228 | 230 | 233 | 235 | 237 | 240 | 244 | 245 | 249 | 253 | 255 | 259 | 265 | 265 | 271 | 279 | 277 | 286 |
| X1,t | 224 | 216 | 210 | 204 | 197 | 191 | 185 | 178 | 172 | 165 | 158 | 151 | 145 | 136 | 130 | 123 | 114 | 107 | 99.6 | 89.1 | 81.8 |
| Zc,t | 400 | 400 | 404 | 408 | 411 | 416 | 421 | 424 | 429 | 435 | 438 | 445 | 452 | 455 | 463 | 473 | 473 | 485 | 498 | 495 | 511 |
| LPSc | 0.5 | 0.5 | 0.5 | 0.53 | 0.53 | 0.53 | 0.56 | 0.56 | 0.56 | 0.6 | 0.6 | 0.6 | 0.64 | 0.64 | 0.64 | 0.68 | 0.68 | 0.68 | 0.74 | 0.74 | 0.74 |
| r,t | 140 | 135 | 130 | 125 | 120 | 115 | 110 | 105 | 100 | 95 | 90 | 85 | 80 | 75 | 70 | 65 | 60 | 55 | 50 | 45 | 40 |
| Pc,x,t | 1.79 | 1.79 | 1.79 | 1.79 | 1.79 | 1.79 | 1.79 | 1.79 | 1.79 | 1.79 | 1.79 | 1.79 | 1.79 | 1.79 | 1.79 | 1.79 | 1.79 | 1.79 | 1.79 | 1.79 | 1.79 |
| P1,x,t' | 1.79 | 1.85 | 1.92 | 2 | 2.08 | 2.17 | 2.27 | 2.38 | 2.5 | 2.63 | 2.78 | 2.94 | 3.13 | 3.33 | 3.57 | 3.85 | 4.17 | 4.55 | 5 | 5.56 | 6.25 |
| Pc,z,t | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Rt | 1 | 1.01 | 1.02 | 1.03 | 1.04 | 1.05 | 1.06 | 1.07 | 1.09 | 1.1 | 1.11 | 1.13 | 1.14 | 1.16 | 1.18 | 1.18 | 1.21 | 1.25 | 1.24 | 1.28 | 1.33 |
| Ut | 815 | 805 | 803 | 800 | 796 | 794 | 791 | 785 | 782 | 779 | 771 | 768 | 765 | 752 | 749 | 746 | 727 | 723 | 720 | 691 | 686 |

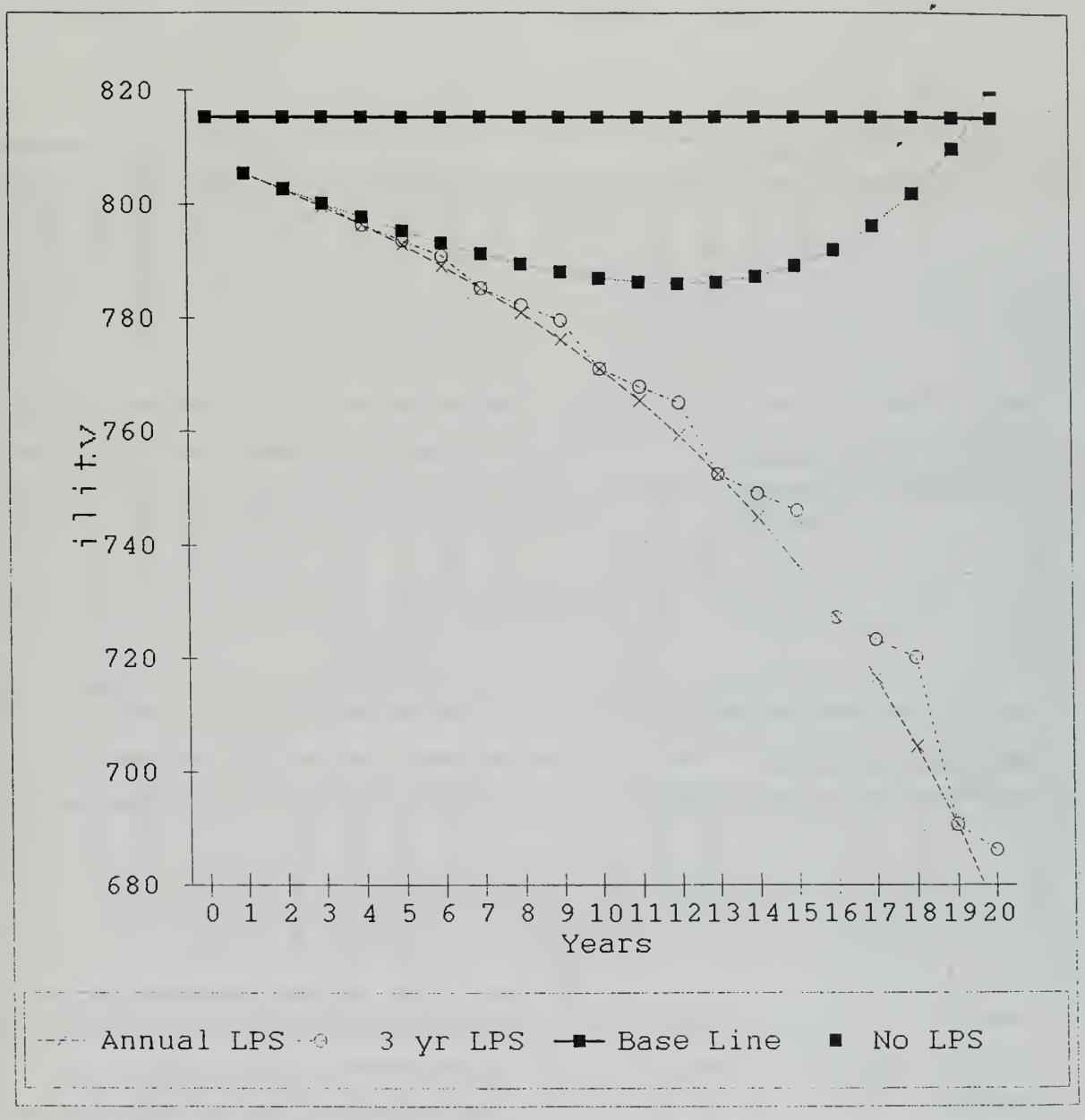
No LPS/Declining Exchange Rate

| Year | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| It | 1200 | 1200 | 1211 | 1223 | 1236 | 1250 | 1265 | 1282 | 1300 | 1320 | 1342 | 1367 | 1394 | 1425 | 1460 | 1500 | 1546 | 1600 | 1664 | 1740 | 1833 |
| Xc,t | 224 | 224 | 226 | 228 | 231 | 233 | 236 | 239 | 243 | 246 | 251 | 255 | 260 | 266 | 273 | 280 | 289 | 299 | 311 | 325 | 342 |
| X1,t | 224 | 216 | 210 | 204 | 198 | 192 | 186 | 179 | 173 | 167 | 161 | 155 | 149 | 143 | 136 | 130 | 124 | 117 | 111 | 104 | 97.8 |
| Zc,t | 400 | 400 | 404 | 408 | 412 | 417 | 422 | 427 | 433 | 440 | 447 | 456 | 465 | 475 | 487 | 500 | 515 | 533 | 555 | 580 | 611 |
| LPSc | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| r,t | 140 | 135 | 130 | 125 | 120 | 115 | 110 | 105 | 100 | 95 | 90 | 85 | 80 | 75 | 70 | 65 | 60 | 55 | 50 | 45 | 40 |
| Pc,x,t | 1.79 | 1.79 | 1.79 | 1.79 | 1.79 | 1.79 | 1.79 | 1.79 | 1.79 | 1.79 | 1.79 | 1.79 | 1.79 | 1.79 | 1.79 | 1.79 | 1.79 | 1.79 | 1.79 | 1.79 | 1.79 |
| P1,x,t' | 1.79 | 1.85 | 1.92 | 2 | 2.08 | 2.17 | 2.27 | 2.38 | 2.5 | 2.63 | 2.78 | 2.94 | 3.13 | 3.33 | 3.57 | 3.85 | 4.17 | 4.55 | 5 | 5.56 | 6.25 |
| Pc,z,t | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Rt | 1 | 1.01 | 1.02 | 1.03 | 1.04 | 1.05 | 1.07 | 1.08 | 1.1 | 1.12 | 1.14 | 1.16 | 1.19 | 1.22 | 1.25 | 1.29 | 1.33 | 1.39 | 1.45 | 1.53 | 1.63 |
| Ut | 815 | 805 | 803 | 800 | 798 | 795 | 793 | 791 | 790 | 788 | 787 | 786 | 786 | 786 | 787 | 789 | 792 | 796 | 802 | 810 | 820 |

Declining Exchange Rate

| Year | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Annual LPS | 815 | 805 | 803 | 800 | 796 | 793 | 789 | 785 | 781 | 776 | 771 | 765 | 759 | 752 | 745 | 737 | 727 | 717 | 705 | 691 | 675 |
| 3 yr LPS | 815 | 805 | 803 | 800 | 796 | 794 | 791 | 785 | 782 | 779 | 771 | 768 | 765 | 752 | 749 | 746 | 727 | 723 | 720 | 691 | 686 |
| Base Line | 815 | 815 | 815 | 815 | 815 | 815 | 815 | 815 | 815 | 815 | 815 | 815 | 815 | 815 | 815 | 815 | 815 | 815 | 815 | 815 | 815 |
| No LPS | 815 | 805 | 803 | 800 | 798 | 795 | 793 | 791 | 790 | 788 | 787 | 786 | 786 | 786 | 787 | 789 | 792 | 796 | 802 | 810 | 820 |

**DECLINING RATE OF EXCHANGE**



# INCREASING RATE OF EXCHANGE

Model/Assumptions

U = 3(Xc^I)(Xl^μ)(Zc^$)
Pc,z = Pus,z = 1
Pc,x = Pus,x
P1,x/r = P1,x'
at t = 0, P1,x' = Pc,x = Pus,x
(Pus,z)(Qus,z)/Ius = I = 1/2
(Pus,x)(Qus,x)/Ius = (1 - I) = 1/2
If,t = Rt-1•Ius,o
R = {[Pc,x•(Xc/(Xc + X1) + P1,x'•(X1/(Xc + X1)]/Px,us}•0.5 + Pz,c=0.5

| I | μ | $ | r | Δr | Pus,z | P1,x | I | (1 -I Io |
|---|---|---|---|---|---|---|---|---|
| 0.33 | 0.33 | 0.33 | 80 | 5 | 1 | 250 | 0.5 | 0.5 | 1200 |

**Annual LPS/Increasing Exchange Rate**

| Year | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| It | 1200 | 1200 | 1182 | 1165 | 1149 | 1133 | 1119 | 1105 | 1092 | 1080 | 1068 | 1057 | 1047 | 1036 | 1027 | 1017 | 1009 | 1000 | 992 | 984 | 976 |
| Xc,t | 128 | 128 | 126 | 124 | 123 | 121 | 119 | 118 | 117 | 115 | 114 | 113 | 112 | 111 | 110 | 109 | 108 | 107 | 106 | 105 | 104 |
| Xl,t | 128 | 136 | 142 | 148 | 153 | 159 | 164 | 169 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 234 |
| Zc,t | 400 | 400 | 394 | 388 | 383 | 378 | 373 | 368 | 364 | 360 | 356 | 352 | 349 | 345 | 342 | 339 | 336 | 333 | 331 | 328 | 325 |
| LPSc | 0.5 | 0.48 | 0.47 | 0.46 | 0.44 | 0.43 | 0.42 | 0.41 | 0.4 | 0.39 | 0.38 | 0.37 | 0.36 | 0.36 | 0.35 | 0.34 | 0.33 | 0.33 | 0.32 | 0.31 | 0.31 |
| r,t | 80 | 85 | 90 | 95 | 100 | 105 | 110 | 115 | 120 | 125 | 130 | 135 | 140 | 145 | 150 | 155 | 160 | 165 | 170 | 175 | 180 |
| Pc,x,t | 3.13 | 3.13 | 3.13 | 3.13 | 3.13 | 3.13 | 3.13 | 3.13 | 3.13 | 3.13 | 3.13 | 3.13 | 3.13 | 3.13 | 3.13 | 3.13 | 3.13 | 3.13 | 3.13 | 3.13 | 3.13 |
| P1,x,t' | 3.13 | 2.94 | 2.78 | 2.63 | 2.5 | 2.38 | 2.27 | 2.17 | 2.08 | 2 | 1.92 | 1.85 | 1.79 | 1.72 | 1.67 | 1.61 | 1.56 | 1.52 | 1.47 | 1.43 | 1.39 |
| Pc,z,t | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Rt | 1 | 0.98 | 0.97 | 0.96 | 0.94 | 0.93 | 0.92 | 0.91 | 0.9 | 0.89 | 0.88 | 0.87 | 0.86 | 0.86 | 0.85 | 0.84 | 0.83 | 0.83 | 0.82 | 0.81 | 0.81 |
| Ut | 561 | 573 | 575 | 577 | 579 | 581 | 582 | 584 | 585 | 586 | 588 | 589 | 590 | 591 | 592 | 593 | 594 | 596 | 597 | 598 | 599 |

**3 Year LPS/Increasing Exchange Rate**

| Year | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| It | 1200 | 1200 | 1182 | 1167 | 1149 | 1135 | 1122 | 1105 | 1094 | 1084 | 1068 | 1059 | 1051 | 1036 | 1029 | 1022 | 1009 | 1002 | 996 | 984 | 979 |
| Xc,t | 128 | 128 | 126 | 124 | 123 | 121 | 120 | 118 | 117 | 116 | 114 | 113 | 112 | 111 | 110 | 109 | 108 | 107 | 106 | 105 | 104 |
| Xl,t | 128 | 136 | 142 | 148 | 153 | 159 | 165 | 169 | 175 | 181 | 185 | 191 | 196 | 200 | 206 | 211 | 215 | 220 | 226 | 230 | 235 |
| Zc,t | 400 | 400 | 394 | 389 | 383 | 378 | 374 | 368 | 365 | 361 | 356 | 353 | 350 | 345 | 343 | 341 | 336 | 334 | 332 | 328 | 326 |
| LPSc | 0.5 | 0.5 | 0.5 | 0.46 | 0.46 | 0.46 | 0.42 | 0.42 | 0.42 | 0.39 | 0.39 | 0.39 | 0.36 | 0.36 | 0.36 | 0.34 | 0.34 | 0.34 | 0.32 | 0.32 | 0.32 |
| r,t | 80 | 85 | 90 | 95 | 100 | 105 | 110 | 115 | 120 | 125 | 130 | 135 | 140 | 145 | 150 | 155 | 160 | 165 | 170 | 175 | 180 |
| Pc,x,t | 3.13 | 3.13 | 3.13 | 3.13 | 3.13 | 3.13 | 3.13 | 3.13 | 3.13 | 3.13 | 3.13 | 3.13 | 3.13 | 3.13 | 3.13 | 3.13 | 3.13 | 3.13 | 3.13 | 3.13 | 3.13 |
| P1,x,t' | 3.13 | 2.94 | 2.78 | 2.63 | 2.5 | 2.38 | 2.27 | 2.17 | 2.08 | 2 | 1.92 | 1.85 | 1.79 | 1.72 | 1.67 | 1.61 | 1.56 | 1.52 | 1.47 | 1.43 | 1.39 |
| Pc,z,t | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Rt | 1 | 0.99 | 0.97 | 0.96 | 0.95 | 0.94 | 0.92 | 0.91 | 0.9 | 0.89 | 0.88 | 0.88 | 0.86 | 0.86 | 0.85 | 0.84 | 0.84 | 0.83 | 0.82 | 0.82 | 0.81 |
| Ut | 561 | 573 | 575 | 578 | 579 | 581 | 584 | 584 | 586 | 589 | 588 | 590 | 593 | 591 | 594 | 596 | 594 | 597 | 599 | 598 | 600 |

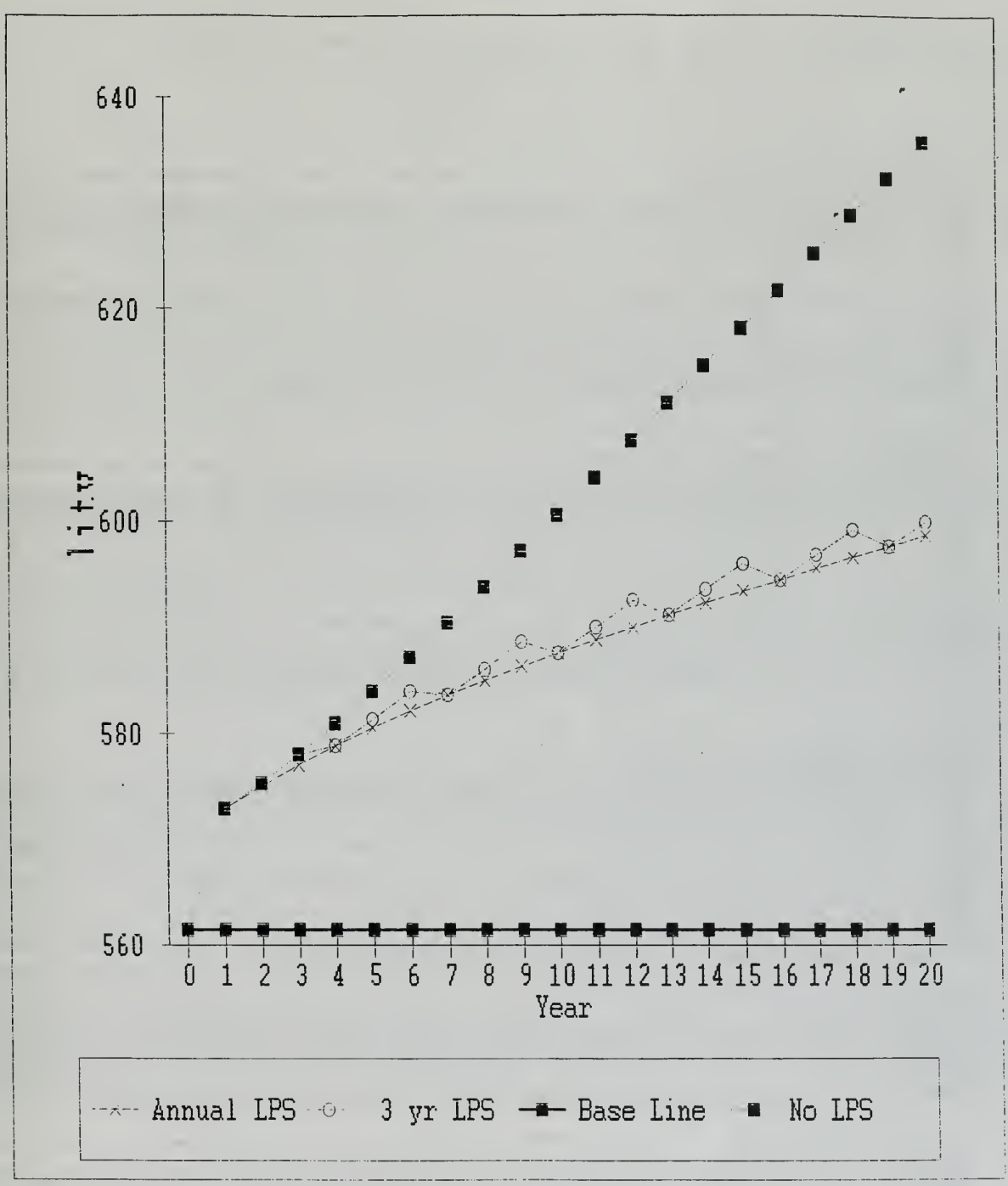
**No LPS/Increasing Exchange Rate**

| Year | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| It | 1200 | 1200 | 1182 | 1167 | 1153 | 1140 | 1129 | 1118 | 1109 | 1100 | 1092 | 1085 | 1078 | 1071 | 1066 | 1060 | 1055 | 1050 | 1045 | 1041 | 1037 |
| Xc,t | 128 | 128 | 126 | 124 | 123 | 122 | 120 | 119 | 118 | 117 | 116 | 116 | 115 | 114 | 114 | 113 | 113 | 112 | 112 | 111 | 111 |
| Xl,t | 128 | 136 | 142 | 148 | 154 | 160 | 166 | 171 | 177 | 183 | 189 | 195 | 201 | 207 | 213 | 219 | 225 | 231 | 237 | 243 | 249 |
| Zc,t | 400 | 400 | 394 | 389 | 384 | 380 | 376 | 373 | 370 | 367 | 364 | 362 | 359 | 357 | 355 | 353 | 352 | 350 | 348 | 347 | 346 |
| LPSc | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| r,t | 80 | 85 | 90 | 95 | 100 | 105 | 110 | 115 | 120 | 125 | 130 | 135 | 140 | 145 | 150 | 155 | 160 | 165 | 170 | 175 | 180 |
| Pc,x,t | 3.13 | 3.13 | 3.13 | 3.13 | 3.13 | 3.13 | 3.13 | 3.13 | 3.13 | 3.13 | 3.13 | 3.13 | 3.13 | 3.13 | 3.13 | 3.13 | 3.13 | 3.13 | 3.13 | 3.13 | 3.13 |
| P1,x,t' | 3.13 | 2.94 | 2.78 | 2.63 | 2.5 | 2.38 | 2.27 | 2.17 | 2.08 | 2 | 1.92 | 1.85 | 1.79 | 1.72 | 1.67 | 1.61 | 1.56 | 1.52 | 1.47 | 1.43 | 1.39 |
| Pc,z,t | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Rt | 1 | 0.99 | 0.97 | 0.96 | 0.95 | 0.94 | 0.93 | 0.92 | 0.92 | 0.91 | 0.9 | 0.9 | 0.89 | 0.89 | 0.88 | 0.88 | 0.88 | 0.87 | 0.87 | 0.86 | 0.86 |
| Ut | 561 | 573 | 575 | 578 | 581 | 584 | 587 | 590 | 594 | 597 | 601 | 604 | 608 | 611 | 615 | 618 | 622 | 625 | 629 | 632 | 636 |

**Increasing Exchange Rate**

| Year | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Annual LPS | 561 | 573 | 575 | 577 | 579 | 581 | 582 | 584 | 585 | 586 | 588 | 589 | 590 | 591 | 592 | 593 | 594 | 596 | 597 | 598 | 599 |
| 3 yr LPS | 561 | 573 | 575 | 578 | 579 | 581 | 584 | 584 | 586 | 589 | 588 | 590 | 593 | 591 | 594 | 596 | 594 | 597 | 599 | 598 | 600 |
| Base Line | 561 | 561 | 561 | 561 | 561 | 561 | 561 | 561 | 561 | 561 | 561 | 561 | 561 | 561 | 561 | 561 | 561 | 561 | 561 | 561 | 561 |
| No LPS | 561 | 573 | 575 | 578 | 581 | 584 | 587 | 590 | 594 | 597 | 601 | 604 | 608 | 611 | 615 | 618 | 622 | 625 | 629 | 632 | 636 |

## INCREASING RATE OF EXCHANGE



# ACTUAL DATA

Model/Assumptions

U = 3(Xc^I)(X1^μ)(Zc^$)
Pc.z = Pus.z = 1
Pc.x = Pus.x
Pl.x/1 = Pl.x'
at t = 0, Pl.x' = Pc.x = Pus.x
(Pus.z)(Qus.z)/Ius = I = 1/2
(Pus.x)(Qus.x)/Ius = (1 − I) = 1/2
It,t = Rt−1*Ius,0
R = {[Pc.x*(Xc/(Xc + X1) + Pl.x'*(X1/(Xc + X1)]/Px.us)*0 5 + Pz.c*0 5

| I | μ | $ | r | Er | Pus.z | Pl.x | I | (1 −I) Io |
|---|---|---|---|---|---|---|---|---|
| 0 333 | 0 333 | 0 333 | 125 | −1 | 1 | 250 | 0 5 | 0 5 | 1200 |

Annual LPS/Actual Exchange Rates

| Year | | 1/92 | 2/92 | 3/92 | 4/92 | 5/92 | 6/92 | 7/92 | 8/92 | 9/92 | 10/92 | 11/92 | 12/92 | 1/93 | 2/93 | 3/93 | 4/93 | 5/93 | 6/93 | 7/93 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| It | 1200 | 1200 | 1199 | 1196 | 1183 | 1180 1 | 1185 | 1195 | 1199 | 1196 | 1204 | 1209 5 | 1203 4 | 1203 | 1200 | 1208 | 1219 | 1231 | 1236 | 1245 |
| Xc.t | 200 | 200 | 199 9 | 199.3 | 197 2 | 196 69 | 197 6 | 199.1 | 199.8 | 199 3 | 200 7 | 201 58 | 200.57 | 200 4 | 200 | 201 3 | 203 2 | 205 1 | 206 | 207 5 |
| X1.t | 200 | 200 4 | 202 8 | 210.9 | 210 7 | 206 47 | 201 1 | 199.9 | 202.5 | 196 4 | 194 5 | 199 28 | 198.79 | 200.3 | 195 1 | 188 7 | 183 6 | 182 | 177 2 | 179 |
| Zc.t | 400 | 400 | 399 8 | 398.5 | 394 3 | 393.37 | 395 1 | 398.2 | 399.6 | 398 7 | 401 5 | 403 16 | 401 15 | 400 9 | 400 1 | 402 5 | 406 5 | 410 2 | 412 | 415 |
| LPSc | 0 5 | 0 499 | 0 496 | 0 486 | 0 483 | 0.4879 | 0 496 | 0 499 | 0 497 | 0.504 | 0 508 | 0.5029 | 0.5022 | 0 5 | 0 506 | 0 516 | 0 525 | 0 53 | 0 538 | 0.537 |
| r.t | 125 | 125.26 | 126.8 | 132.32 | 133.57 | 131.217 | 127.24 | 125.49 | 126.67 | 123.1 | 121.12 | 123.58 | 123.89 | 124.9 | 121.9 | 117.2 | 112.9 | 110.9 | 107.54 | 107.86 |
| Pc.x.t | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Pl.x.t' | 2 | 1 996 | 1 971 | 1 889 | 1 872 | 1 9052 | 1 965 | 1 992 | 1 974 | 2 03 | 2 064 | 2 0231 | 2 018 | 2 002 | 2 051 | 2 133 | 2 214 | 2 254 | 2 325 | 2 318 |
| Pc.z.t | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Rt | 1 | 0 999 | 0 996 | 0 986 | 0 983 | 0 9879 | 0 996 | 0 999 | 0 997 | 1 004 | 1 008 | 1 0029 | 1 0022 | 1 | 1 006 | 1 016 | 1 025 | 1 03 | 1 038 | 1 037 |
| Ut | | 756 5 | 759 2 | 767 6 | 761 9 | 755 55 | 751 2 | 753 6 | 758 6 | 749 7 | 750 8 | 759 01 | 755 86 | 757 4 | 749 8 | 744 5 | 742 5 | 744 9 | 740 5 | 746 7 |

3 Year LPS/Actual Exchange Rates

| Year | | 1/92 | 2/92 | 3/92 | 4/92 | 5/92 | 6/92 | 7/92 | 8/92 | 9/92 | 10/92 | 11/92 | 12/92 | 1/93 | 2/93 | 3/93 | 4/93 | 5/93 | 6/93 | 7/93 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| It | 1200 | 1200 | 1199 | 1196 | 1183 | 1180 2 | 1185 | 1195 | 1199 | 1196 | 1204 | 1209 6 | 1203 4 | 1203 | 1200 | 1208 | 1219 | 1231 | 1237 | 1245 |
| Xc.t | 200 | 200 | 199 9 | 199 3 | 197 2 | 196 7 | 197 6 | 199 1 | 199 8 | 199 3 | 200 7 | 201 59 | 200 57 | 200 4 | 200 | 201 3 | 203 2 | 205 2 | 206 2 | 207 5 |
| X1.t | 200 | 200 4 | 202 8 | 210 9 | 210 7 | 206 48 | 201 1 | 199 9 | 202 5 | 196 4 | 194 5 | 199 29 | 198 79 | 200 3 | 195 1 | 188 7 | 183 6 | 182 | 177 4 | 179 |
| Zc.t | 400 | 400 | 399 8 | 398 5 | 394 3 | 393 4 | 395 1 | 398 2 | 399 6 | 398 7 | 401 5 | 403 18 | 401 14 | 400 9 | 400 1 | 402 5 | 406 5 | 410 4 | 412 3 | 415 |
| LPSc | 0 5 | 0 5 | 0 5 | 0 486 | 0 486 | 0 4858 | 0 496 | 0 496 | 0 496 | 0 504 | 0 504 | 0 5037 | 0 5022 | 0 502 | 0 502 | 0 516 | 0 516 | 0 516 | 0 538 | 0 538 |
| r.t | 125 | 125.26 | 126 8 | 132.32 | 133.57 | 131.217 | 127.24 | 125.49 | 126.67 | 123.1 | 121.12 | 123.58 | 123.89 | 124.9 | 121.9 | 117.2 | 112.9 | 110.9 | 107.54 | 107.86 |
| Pc.x.t | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Pl.x.t' | 2 | 1 996 | 1 971 | 1 889 | 1 872 | 1 9052 | 1 965 | 1 992 | 1 974 | 2 03 | 2 064 | 2 0231 | 2 018 | 2 002 | 2 051 | 2 133 | 2 214 | 2 254 | 2 325 | 2 318 |
| Pc.z.t | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Rt | 1 | 0 999 | 0 996 | 0 986 | 0 984 | 0 9878 | 0 996 | 0 999 | 0 997 | 1 004 | 1 008 | 1 0029 | 1 0022 | 1 | 1 006 | 1 016 | 1 026 | 1 031 | 1 038 | 1 037 |
| Ut | | 756 5 | 759 2 | 767 6 | 761 9 | 755 61 | 751 2 | 753 6 | 758 6 | 749 7 | 750 8 | 759 06 | 755 86 | 757 4 | 749 8 | 744 5 | 742 5 | 745 2 | 741 1 | 746 7 |

No LPS/Actual Exchange Rates

| Year | | 1/92 | 2/92 | 3/92 | 4/92 | 5/92 | 6/92 | 7/92 | 8/92 | 9/92 | 10/92 | 11/92 | 12/92 | 1/93 | 2/93 | 3/93 | 4/93 | 5/93 | 6/93 | 7/93 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| It | 1200 | 1200 | 1199 | 1196 | 1183 | 1180 8 | 1186 | 1195 | 1199 | 1196 | 1205 | 1209 6 | 1203 5 | 1203 | 1200 | 1208 | 1220 | 1232 | 1238 | 1249 |
| Xc.t | 200 | 200 | 199 9 | 199 3 | 197.2 | 196 79 | 197 6 | 199 1 | 199.8 | 199 3 | 200.8 | 201.6 | 200.58 | 200.4 | 200 | 201.3 | 203.3 | 205 4 | 206 4 | 208 1 |
| X1.t | 200 | 200.4 | 202 8 | 210 9 | 210 8 | 206 58 | 201 2 | 199 9 | 202 5 | 196 4 | 194.5 | 199 31 | 198.79 | 200.3 | 195 1 | 188.7 | 183 7 | 182 2 | 177 5 | 179 6 |
| Zc.t | 400 | 400 | 399 8 | 398 5 | 394 5 | 393 59 | 395 3 | 398 2 | 399 6 | 398 7 | 401 5 | 403.21 | 401.15 | 400 9 | 400.1 | 402 5 | 406 7 | 410.7 | 412 7 | 416 2 |
| LPSc | 0.5 | 0 5 | 0 5 | 0 5 | 0 5 | 0 5 | 0 5 | 0 5 | 0 5 | 0 5 | 0 5 | 0 5 | 0 5 | 0 5 | 0 5 | 0.5 | 0.5 | 0.5 | 0 5 | 0 5 |
| r.t | 125 | 125.26 | 126.8 | 132.32 | 133.57 | 131.217 | 127.24 | 125.49 | 126.67 | 123.1 | 121.12 | 123.58 | 123.89 | 124.9 | 121.9 | 117.2 | 112.9 | 110.9 | 107.54 | 107.86 |
| Pc.x.t | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Pl.x.t' | 2 | 1 996 | 1.971 | 1 889 | 1 872 | 1 9052 | 1 965 | 1.992 | 1 974 | 2 03 | 2 064 | 2 0231 | 2.018 | 2.002 | 2 051 | 2.133 | 2.214 | 2 254 | 2.325 | 2 318 |
| Pc.z.t | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Rt | 1 | 0 999 | 0 996 | 0 986 | 0 984 | 0.9882 | 0 996 | 0.999 | 0 997 | 1 004 | 1.008 | 1.0029 | 1.0022 | 1 | 1.006 | 1.017 | 1.027 | 1.032 | 1.041 | 1.04 |
| Ut | | 756 5 | 759 2, | 767 6 | 762 2 | 755 96 | 751 4 | 753 6 | 758.6 | 749 7 | 750 9 | 759 11 | 755 87 | 757 5 | 749 8 | 744 6 | 742.9 | 745.8 | 741 8 | 748 9 |

Actual Exchange Rates

| Month | | 1/92 | 2/92 | 3/92 | 4/92 | 5/92 | 6/92 | 7/92 | 8/92 | 9/92 | 10/92 | 11/92 | 12/92 | 1/93 | 2/93 | 3/93 | 4/93 | 5/93 | 6/93 | 7/93 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Annual LPS | | 756 5 | 759 2 | 767 6 | 761 9 | 755 55 | 751 2 | 753 6 | 758 6 | 749 7 | 750 8 | 759 01 | 755 86 | 757 4 | 749 8 | 744 5 | 742.5 | 744 9 | 740 5 | 746.7 |
| 3 yr LPS | | 756 5 | 759 2 | 767 6 | 761 9 | 755 61 | 751 2 | 753 6 | 758 6 | 749 7 | 750 8 | 759 06 | 755 86 | 757.4 | 749 8 | 744 5 | 742.5 | 745 2 | 741 1 | 746 7 |
| Base Line | 756 | 756 | 756 | 756 | 756 | 756 | 756 | 756 | 756 | 756 | 756 | 756 | 756 | 756 | 756 | 756 | 756 | 756 | 756 | 756 |
| No LPS | | 756 5 | 759 2 | 767 6 | 762 2 | 755 96 | 751 4 | 753 6 | 758 6 | 749 7 | 750 9 | 759 11 | 755 87 | 757.5 | 749 8 | 744 6 | 742.9 | 745.8 | 741 8 | 748 9 |

Exchange rate and COLA Index

| Month | 1/92 | 2/92 | 3/92 | 4/92 | 5/92 | 6/92 | 7/92 | 8/92 | 9/92 | 10/92 | 11/92 | 12/92 | 1/93 | 2/93 | 3/93 | 4/93 | 5/93 | 6/93 | 7/93 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Exchange Rate | 125 3 | 126 8 | 132 3 | 133 6 | 131.22 | 127 2 | 125 5 | 126 7 | 123 1 | 121 1 | 123 58 | 123.89 | 124 9 | 121.9 | 117 2 | 112 9 | 110.9 | 107 5 | 107 9 |
| Annual LPS | 0 999 | 0 996 | 0 986 | 0 983 | 0.9879 | 0 996 | 0 999 | 0 997 | 1 004 | 1 008 | 1 0029 | 1 0022 | 1 | 1 006 | 1 016 | 1 025 | 1 03 | 1 038 | 1 037 |
| 3 yr LPS | 0 999 | 0 996 | 0 986 | 0 984 | 0 9878 | 0 996 | 0 999 | 0 997 | 1 004 | 1 008 | 1 0029 | 1 0022 | 1 | 1 006 | 1 016 | 1 026 | 1 031 | 1 038 | 1.037 |
| No LPS | 0 999 | 0 996 | 0 986 | 0 984 | 0 9882 | 0 996 | 0 999 | 0 997 | 1 004 | 1 008 | 1 0029 | 1 0022 | 1 | 1 006 | 1 017 | 1 027 | 1 032 | 1 041 | 1 04 |

# ACTUAL DATA

**Annual LPS/Actual Exchange Rates** (Annua)

| 7/93 | 8/93 | 9/93 | 10/93 | 11/93 | 12/93 | 1/94 | 2/94 | 3/94 | 4/94 | 5/94 | 6/94 | 7/94 | 8/94 | 9/94 | 10/94 | 11/94 | 12/94 | 1/95 | 2/95 | 3/95 | 4/95 | 5/95 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1245 | 1244 | 1256 | 1252 | 1248 | 1244 4 | 1240 | 1233 | 1247 | 1251 6 | 1256 | 1256 | 1257 4 | 1271 | 1267 3 | 1269 8 | 1270 63 | 1273 2 | 1266 4 | 1267 | 1271 | 1292 | 1317 |
| 207 5 | 207 4 | 209 3 | 208 6 | 208 | 207 4 | 206 7 | 205 6 | 207.9 | 208.59 | 209 4 | 209 4 | 209 57 | 211 8 | 211.21 | 211 64 | 211 816 | 212.2 | 211 06 | 211.2 | 211 8 | 215 4 | 219 6 |
| 179 | 172.2 | 176 | 177.7 | 179 4 | 181.49 | 184 8 | 175 6 | 175 | 172.78 | 173.5 | 172 8 | 165 24 | 169.1 | 167 18 | 166.91 | 165.741 | 169 93 | 168 62 | 166.5 | 155 3 | 144 9 | 149 5 |
| 415 | 414 7 | 418.5 | 417 3 | 416 | 414 79 | 413.3 | 411 2 | 415 8 | 417.19 | 418.8 | 418 7 | 419 13 | 423.7 | 422 42 | 423 27 | 423 631 | 424 41 | 422 13 | 422 4 | 423.7 | 430 8 | 439 1 |
| 0 537 | 0 546 | 0.543 | 0 54 | 0 537 | 0.5333 | 0 528 | 0 539 | 0 543 | 0 5469 | 0.547 | 0 548 | 0 5591 | 0.556 | 0 5582 | 0.5591 | 0 56102 | 0 5553 | 0 5559 | 0 559 | 0 577 | 0 598 | 0 595 |
| 107.86 | 103.8 | 105.1 | 106.47 | 107.78 | 109.39 | 111.8 | 106.75 | 105.22 | 103.54 | 103.6 | 103.2 | 98.56 | 99.8 | 98.94 | 98.583 | 97.81 | 100.097 | 99.863 | 98.56 | 91.64 | 84.11 | 85.14 |
| 2 | 2 | .2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 2.318 | 2 408 | 2.378 | 2.348 | 2.32 | 2.2855 | 2.236 | 2.342 | 2.376 | 2 4145 | 2.414 | 2.423 | 2.5365 | 2.505 | 2.5268 | 2.5359 | 2.55598 | 2 4976 | 2 5034 | 2 536 | 2.728 | 2 972 | 2 936 |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 1.037 | 1 046 | 1.043 | 1.04 | 1.037 | 1 0333 | 1 028 | 1.039 | 1.043 | 1.0469 | 1.047 | 1.048 | 1 0591 | 1.056 | 1.0582 | 1.0591 | 1.06102 | 1 0553 | 1 0559 | 1 059 | 1 077 | 1.098 | 1 095 |
| 746 7 | 736 7 | 746 6 | 747 6 | 748 3 | 749 81 | 752 6 | 737 2 | 741 9 | 740 46 | 743 4 | 742 3 | 731 78 | 742 8 | 738 47 | 739 07 | 737 757 | 744 82 | 740 24 | 737 4 | 721 9 | 713 4 | 730 2 |

**3 Year LPS/Actual Exchange Rates** (3 Yea)

| 7/93 | 8/93 | 9/93 | 10/93 | 11/93 | 12/93 | 1/94 | 2/94 | 3/94 | 4/94 | 5/94 | 6/94 | 7/94 | 8/94 | 9/94 | 10/94 | 11/94 | 12/94 | 1/95 | 2/95 | 3/95 | 4/95 | 5/95 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1245 | 1244 | 1257 | 1253 | 1248 | 1244.3 | 1240 | 1233 | 1247 | 1252.2 | 1258 | 1257 | 1258 7 | 1274 | 1270.1 | 1273 1 | 1274.36 | 1277 1 | 1269 | 1270 | 1274 | 1301 | 1335 |
| 207 5 | 207.4 | 209 4 | 208 8 | 208 | 207 39 | 206 6 | 205 5 | 207 9 | 208 7 | 209.6 | 209 6 | 209 78 | 212 4 | 211 68 | 212.18 | 212.393 | 212 86 | 211 51 | 211.6 | 212 4 | 216 8 | 222 5 |
| 179 | 172 2 | 176 1 | 177 8 | 179 4 | 181 48 | 184 8 | 175 5 | 175 | 172.87 | 173.7 | 173 | 165 41 | 169 6 | 167 55 | 167 34 | 166.193 | 170 45 | 168 97 | 166 9 | 155.7 | 145 9 | 151 5 |
| 415 | 414 7 | 418 9 | 417 5 | 416 1 | 414 78 | 413 2 | 410 9 | 415 8 | 417.39 | 419 2 | 419 1 | 419 56 | 424 8 | 423 35 | 424 36 | 424 785 | 425 71 | 423 01 | 423 3 | 424 8 | 433 7 | 445 |
| 0 538 | 0 538 | 0 538 | 0 538 | 0 538 | 0.5375 | 0.538 | 0 538 | 0.538 | 0.5375 | 0.538 | 0.538 | 0 5375 | 0 538 | 0 5375 | 0 5375 | 0 53755 | 0 5375 | 0 5375 | 0 538 | 0 538 | 0 538 | 0 538 |
| 107.86 | 103.8 | 105.1 | 106.47 | 107.78 | 109.39 | 111.8 | 106.75 | 105.22 | 103.54 | 103.6 | 103.2 | 98.56 | 99.8 | 98.94 | 98.583 | 97.81 | 100.097 | 99.863 | 98.56 | 91.64 | 84.11 | 85.14 |
| 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 2 318 | 2 408 | 2 378 | 2 348 | 2 32 | 2.2855 | 2.236 | 2 342 | 2 376 | 2 4145 | 2 414 | 2 423 | 2 5365 | 2 505 | 2 5268 | 2 5359 | 2 55598 | 2.4976 | 2 5034 | 2 536 | 2 728 | 2 972 | 2 936 |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 1 037 | 1 047 | 1 044 | 1 04 | 1 037 | 1 033 | 1 027 | 1 04 | 1 043 | 1 0479 | 1 048 | 1 049 | 1 062 | 1.058 | 1 0609 | 1 062 | 1 06428 | 1 0575 | 1 0582 | 1 062 | 1 084 | 1 112 | 1 108 |
| 746 7 | 736 7 | 747 2 | 747 9 | 748 5 | 749 78 | 752 4 | 736 8 | 742 | 740 82 | 744 1 | 743 | 732 54 | 744 8 | 740 1 | 740 97 | 739 767 | 747 11 | 741 79 | 739 | 723 9 | 718 2 | 739 9 |

**No LPS/Actual Exchange Rates** (No LP)

| 7/93 | 8/93 | 9/93 | 10/93 | 11/93 | 12/93 | 1/94 | 2/94 | 3/94 | 4/94 | 5/94 | 6/94 | 7/94 | 8/94 | 9/94 | 10/94 | 11/94 | 12/94 | 1/95 | 2/95 | 3/95 | 4/95 | 5/95 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1249 | 1246 | 1261 | 1257 | 1252 | 1247 9 | 1243 | 1235 | 1251 | 1256 4 | 1262 | 1262 | 1263 5 | 1280 | 1275 8 | 1279 | 1280 33 | 1283 4 | 1274 6 | 1276 | 1260 | 1303 | 1346 |
| 208 1 | 207 9 | 210 2 | 209 5 | 208 7 | 207 99 | 207 1 | 205 9 | 208 5 | 209 4 | 210 4 | 210 3 | 210 58 | 213 4 | 212 63 | 213 17 | 213 399 | 213 9 | 212 44 | 212 6 | 213 4 | 218 2 | 224 3 |
| 179 6 | 172 7 | 176.8 | 178 4 | 180 | 182 01 | 185 2 | 175 8 | 175 5 | 173.45 | 174 3 | 173 6 | 166 03 | 170 4 | 168 3 | 168 12 | 166 98 | 171 29 | 169 72 | 167 6 | 156 5 | 146 8 | 152 8 |
| 416 2 | 415 9 | 420 4 | 418 9 | 417 4 | 415 98 | 414 3 | 411 8 | 417 1 | 418 8 | 420 7 | 420 7 | 421 15 | 426 8 | 425 25 | 426 34 | 426 797 | 427 8 | 424 88 | 425 2 | 426 8 | 436 4 | 448 6 |
| 0 5 | 0 5 | 0 5 | 0 5 | 0 5 | 0 5 | 0 5 | 0 5 | 0 5 | 0 5 | 0 5 | 0 5 | 0 5 | 0 5 | 0 5 | 0 5 | 0 5 | 0 5 | 0 5 | 0 5 | 0 5 | 0 5 | 0 5 |
| 107.86 | 103.8 | 105.1 | 106.47 | 107.78 | 109.39 | 111.8 | 106.75 | 105.22 | 103.54 | 103.6 | 103.2 | 98.56 | 99.8 | 98.94 | 98.583 | 97.81 | 100.097 | 99.863 | 98.56 | 91.64 | 84.11 | 85.14 |
| 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 2 318 | 2.408 | 2 378 | 2 348 | 2 32 | 2 2855 | 2 236 | 2 342 | 2 376 | 2 4145 | 2 414 | 2 423 | 2 5365 | 2 505 | 2 5268 | 2 5359 | 2 55598 | 2 4976 | 2 5034 | 2 536 | 2 728 | 2 972 | 2 936 |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 1 04 | 1 051 | 1.047 | 1 043 | 1 04 | 1 0357 | 1.03 | 1 043 | 1 047 | 1.0518 | 1 052 | 1 053 | 1.0671 | 1 063 | 1.0658 | 1 067 | 1.0695 | 1 0622 | 1 0629 | 1 067 | 1.091 | 1 122 | 1 117 |
| 748 9 | 738 8 | 750 | 750 5 | 750 8 | 751 94 | 754 3 | 738 4 | 744 3 | 743 33 | 746 8 | 745 8 | 735 31 | 748 3 | 743 42 | 744 42 | 743 271 | 750 78 | 745 07 | 742 3 | 727 3 | 722 7 | 746 |

**Actual Exchange Rates** (Actua)

| 7/93 | 8/93 | 9/93 | 10/93 | 11/93 | 12/93 | 1/94 | 2/94 | 3/94 | 4/94 | 5/94 | 6/94 | 7/94 | 8/94 | 9/94 | 10/94 | 11/94 | 12/94 | 1/95 | 2/95 | 3/95 | 4/95 | 5/95 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 746 7 | 736 7 | 746 6 | 747 6 | 748.3 | 749.81 | 752.6 | 737 2 | 741.3 | 740.46 | 743 4 | 742.3 | 731.78 | 742.8 | 738 47 | 739 07 | 737.757 | 744.82 | 740.24 | 737 4 | 721 9 | 713.4 | 730 2 |
| 746.7 | 736 7 | 747.2 | 747.9 | 748 5 | 749.78 | 752.4 | 736 8 | 742 | 740.82 | 744 1 | 743 | 732.54 | 744 8 | 740 1 | 740 97 | 739.767 | 747 11 | 741.79 | 739 | 723 9 | 718 2 | 739 9 |
| 756 | 756 | 756 | 756 | 756 | 756 | 756 | 756 | 756 | 756 | 756 | 756 | 756 | 756 | 756 | 756 | 756 | 756 | 756 | 756 | 756 | 756 | 756 |
| 748 9 | 738 8 | 750 | 750 5 | 750 8 | 751 94 | 754 3 | 738 4 | 744 3 | 743.33 | 746 8 | 745 8 | 735.31 | 748 3 | 743 42 | 744 42 | 743 271 | 750 78 | 745 07 | 742 3 | 727 3 | 722 7 | 746 |

**Exchange rate and COLA Index** (Excha)

| 7/93 | 8/93 | 9/93 | 10/93 | 11/93 | 12/93 | 1/94 | 2/94 | 3/94 | 4/94 | 5/94 | 6/94 | 7/94 | 8/94 | 9/94 | 10/94 | 11/94 | 12/94 | 1/95 | 2/95 | 3/95 | 4/95 | 5/95 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 107 9 | 103 8 | 105 1 | 106 5 | 107 8 | 103.33 | 111.8 | 106 7 | 105 2 | 103.54 | 103 6 | 103 2 | 98 56 | 99.8 | 98.94 | 98 583 | 97 81 | 100.1 | 99.863 | 98 56 | 91.64 | 84 11 | 85 14 |
| 1 037 | 1 046 | 1 043 | 1 04 | 1 037 | 1 0333 | 1.028 | 1 039 | 1 043 | 1 0469 | 1 047 | 1 048 | 1.0591 | 1 056 | 1 0582 | 1 0591 | 1.06102 | 1.0553 | 1 0559 | 1 059 | 1.077 | 1 098 | 1 095 |
| 1 037 | 1 047 | 1 044 | 1 04 | 1 037 | 1 033 | 1 027 | 1 04 | 1 043 | 1 0479 | 1 048 | 1 049 | 1 062 | 1 058 | 1 0609 | 1 062 | 1 06428 | 1 0575 | 1 0582 | 1 062 | 1 084 | 1 112 | 1 108 |
| 1 04 | 1 051 | 1 047 | 1 043 | 1 04 | 1 0357 | 1 03 | 1 043 | 1 047 | 1 0518 | 1 052 | 1 053 | 1 0671 | 1 063 | 1 0658 | 1 067 | 1 0695 | 1 0622 | 1 0629 | 1 067 | 1 091 | 1 122 | 1 117 |

# ACTUAL DATA

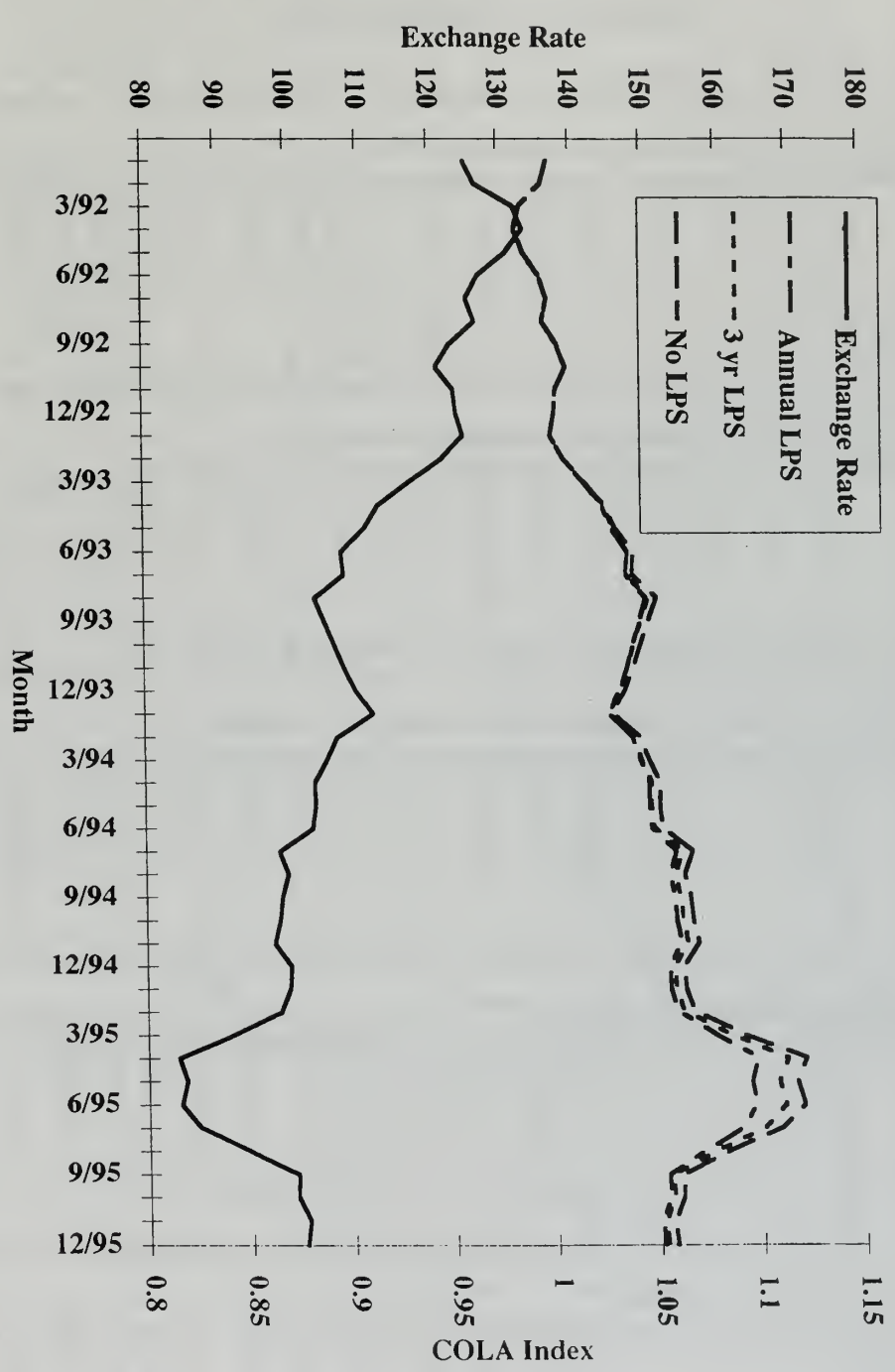
| ıl LPS/Actual Exchange Rates | | | | | | |
|---|---|---|---|---|---|---|
| 6/95 | 7/95 | 8/95 | 9/95 | 10/95 | 11/95 | 12/95 |
| 1314 | 1316 | 1308 | 1285 | 1265 | 1265 | 1260 |
| 219 | 219 | 218 | 214 | 210.8 | 210.8 | 210.1 |
| 148 | 153 | 164 | 173 | 169.6 | 172 2 | 170 9 |
| 438 | 439 | 436 | 428 | 421.6 | 421.6 | 420.1 |
| 0.6 | 0.59 | 0.57 | 0.55 | 0.554 | 0.55 | 0.551 |
| 84.381 | 86.94 | 93.86 | 100.66 | 100.599 | 102.123 | 101.697 |
| 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 2.96 | 2.88 | 2.66 | 2.48 | 2.485 | 2.448 | 2.458 |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 1 1 | 1.09 | 1 07 | 1 05 | 1.054 | 1.05 | 1.051 |
| 726 | 735 | 749 | 753 | 741.1 | 744.9 | 741.3 |

| ır LPS/Actual Exchange Rates | | | | | | |
|---|---|---|---|---|---|---|
| 6/95 | 7/95 | 8/95 | 9/95 | 10/95 | 11/95 | 12/95 |
| 1330 | 1334 | 1321 | 1292 | 1267 | 1267 | 1262 |
| 222 | 222 | 220 | 215 | 211.2 | 211.2 | 210.4 |
| 150 | 155 | 165 | 173 | 170 | 172.6 | 171.1 |
| 443 | 445 | 440 | 431 | 422.4 | 422.4 | 420.7 |
| 0.54 | 0.54 | 0.54 | 0.54 | 0.538 | 0.538 | 0.538 |
| 84.381 | 86.94 | 93.86 | 100.66 | 100.599 | 102.123 | 101.697 |
| 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 2.96 | 2.88 | 2.66 | 2 48 | 2.485 | 2.448 | 2.458 |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 1.11 | 1.1 | 1.08 | 1.06 | 1.056 | 1.052 | 1.053 |
| 735 | 744 | 757 | 757 | 742.5 | 746.3 | 742.3 |

| ⁹S/Actual Exchange Rates | | | | | | |
|---|---|---|---|---|---|---|
| 6/95 | 7/95 | 8/95 | 9/95 | 10/95 | 11/95 | 12/95 |
| 1340 | 1344 | 1331 | 1300 | 1273 | 1273 | 1267 |
| 223 | 224 | 222 | 217 | 212.1 | 212.1 | 211.2 |
| 151 | 156 | 167 | 174 | 170.7 | 173.3 | 171.8 |
| 447 | 448 | 444 | 433 | 424.2 | 424.3 | 422.4 |
| 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| 84.381 | 86.94 | 93.86 | 100.66 | 100.599 | 102.123 | 101.697 |
| 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 2.96 | 2.88 | 2.66 | 2.48 | 2.485 | 2.448 | 2.458 |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 1.12 | 1.11 | 1.08 | 1.06 | 1.061 | 1.056 | 1.057 |
| 741 | 750 | 762 | 762 | 745.7 | 749.6 | 745.2 |

| ıl Exchange Rates | | | | | | |
|---|---|---|---|---|---|---|
| 6/95 | 7/95 | 8/95 | 9/95 | 10/95 | 11/95 | 12/95 |
| 726 | 735 | 749 | 753 | 741.1 | 744.9 | 741.3 |
| 735 | 744 | 757 | 757 | 742.5 | 746.3 | 742.3 |
| 756 | 756 | 756 | 756 | 756 | 756 | 756 |
| 741 | 750 | 762 | 762 | 745.7 | 749.6 | 745.2 |

| ınge rate and COLA Index | | | | | | |
|---|---|---|---|---|---|---|
| 6/95 | 7/95 | 8/95 | 9/95 | 10/95 | 11/95 | 12/95 |
| 84.4 | 86.9 | 93.9 | 101 | 100.6 | 102.1 | 101.7 |
| 1.1 | 1.09 | 1.07 | 1.05 | 1.054 | 1.05 | 1.051 |
| 1.11 | 1.1 | 1.08 | 1.06 | 1.056 | 1.052 | 1.053 |
| 1.12 | 1 11 | 1.08 | 1 06 | 1 061 | 1 056 | 1.057 |


Exchange Rate
80
90
100
110
120
130
140
150
160
170
180
Month
3/92
6/92
9/92
12/92
3/93
6/93
9/93
12/93
3/94
6/94
9/94
12/94
3/95
6/95
9/95
12/95
Exchange Rate
Annual LPS
3 yr LPS
No LPS
0.8
0.85
0.9
0.95
1
1.05
1.1
1.15
COLA Index

| Annual LPS/Cyclical Exchange Rates (3 Year Cycle) | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| It | 1200 | 1200 | 1267 | 1200 | 1145 | 1100 | 1145 | 1200 | 1267 | 1200 | 1145 | 1100 | 1145 | 1200 | 1267 | 1200 | 1145 | 1100 | 1145 | 1200 | 1267 |
| Xc.t | 160 | 160 | 169 | 160 | 153 | 147 | 153 | 160 | 169 | 160 | 153 | 147 | 153 | 160 | 169 | 160 | 153 | 147 | 153 | 160 | 169 |
| Xl.t | 160 | 128 | 169 | 192 | 214 | 176 | 153 | 128 | 169 | 192 | 214 | 176 | 153 | 128 | 169 | 192 | 214 | 176 | 153 | 128 | 169 |
| Zc.t | 400 | 400 | 422 | 400 | 382 | 367 | 382 | 400 | 422 | 400 | 382 | 367 | 382 | 400 | 422 | 400 | 382 | 367 | 382 | 400 | 422 |
| LPSc | 0 5 | 0 56 | 0 5 | 0 45 | 0 42 | 0 45 | 0 5 | 0 56 | 0 5 | 0 45 | 0 42 | 0 45 | 0 5 | 0 56 | 0.5 | 0.45 | 0 42 | 0 45 | 0 5 | 0 56 | 0 5 |
| r.t | 100 | 80 | 100 | 120 | 140 | 120 | 100 | 80 | 100 | 120 | 140 | 120 | 100 | 80 | 100 | 120 | 140 | 120 | 100 | 80 | 100 |
| Pc.x.t | 2 5 | 2 5 | 2.5 | 2.5 | 2 5 | 2 5 | 2 5 | 2 5 | 2 5 | 2 5 | 2.5 | 2 5 | 2 5 | 2 5 | 2.5 | 2 5 | 2 5 | 2.5 | 2 5 | 2 5 | 2 5 |
| Pl.x.t' | 2 5 | 3 13 | 2 5 | 2 08 | 1 79 | 2 08 | 2.5 | 3 13 | 2 5 | 2.08 | 1 79 | 2 08 | 2 5 | 3.13 | 2.5 | 2.08 | 1 79 | 2 08 | 2 5 | 3 13 | 2 5 |
| Pc.z.t | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Rt | 1 | 1 06 | 1 | 0 95 | 0.92 | 0 95 | 1 | 1.06 | 1 | 0.95 | 0.92 | 0 95 | 1 | 1.06 | 1 | 0 95 | 0 92 | 0 95 | 1 | 1.06 | 1 |
| Ut | 651 | 605 | 688 | 692 | 696 | 635 | 622 | 605 | 688 | 692 | 696 | 635 | 622 | 605 | 688 | 692 | 696 | 635 | 622 | 605 | 688 |

| 3 Year LPS (At Peaks and Troughs)/Cyclical Exchange Rates (3 Year Cycle) | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| It | 1200 | 1200 | 1267 | 1200 | 1156 | 1100 | 1142 | 1200 | 1267 | 1200 | 1156 | 1100 | 1142 | 1200 | 1267 | 1200 | 1156 | 1100 | 1142 | 1200 | 1267 |
| Xc.t | 160 | 160 | 169 | 160 | 154 | 147 | 152 | 160 | 169 | 160 | 154 | 147 | 152 | 160 | 169 | 160 | 154 | 147 | 152 | 160 | 169 |
| Xl.t | 160 | 128 | 169 | 192 | 216 | 176 | 152 | 128 | 169 | 192 | 216 | 176 | 152 | 128 | 169 | 192 | 216 | 176 | 152 | 128 | 169 |
| Zc.t | 400 | 400 | 422 | 400 | 385 | 367 | 381 | 400 | 422 | 400 | 385 | 367 | 381 | 400 | 422 | 400 | 385 | 367 | 381 | 400 | 422 |
| LPSc | 0 42 | 0.56 | 0.56 | 0.56 | 0 42 | 0.42 | 0 42 | 0 56 | 0.56 | 0.56 | 0 42 | 0 42 | 0 42 | 0.56 | 0 56 | 0.56 | 0.42 | 0 42 | 0.42 | 0 56 | 0.56 |
| r.t | 100 | 80 | 100 | 120 | 140 | 120 | 100 | 80 | 100 | 120 | 140 | 120 | 100 | 80 | 100 | 120 | 140 | 120 | 100 | 80 | 100 |
| Pc.x.t | 2 5 | 2 5 | 2 5 | 2.5 | 2.5 | 2 5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2 5 | 2 5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2 5 | 2 5 |
| Pl.x.t' | 2 5 | 3 13 | 2 5 | 2 08 | 1.79 | 2.08 | 2.5 | 3.13 | 2.5 | 2 08 | 1.79 | 2 08 | 2 5 | 3.13 | 2 5 | 2.08 | 1 79 | 2 08 | 2.5 | 3 13 | 2.5 |
| Pc.z.t | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Rt | 1 | 1 06 | 1 | 0 96 | 0.92 | 0 95 | 1 | 1 06 | 1 | 0.96 | 0 92 | 0.95 | 1 | 1 06 | 1 | 0 96 | 0 92 | 0.95 | 1 | 1 06 | 1 |
| Ut | 651 | 605 | 688 | 692 | 702 | 635 | 620 | 605 | 688 | 692 | 702 | 635 | 620 | 605 | 688 | 692 | 702 | 635 | 620 | 605 | 688 |

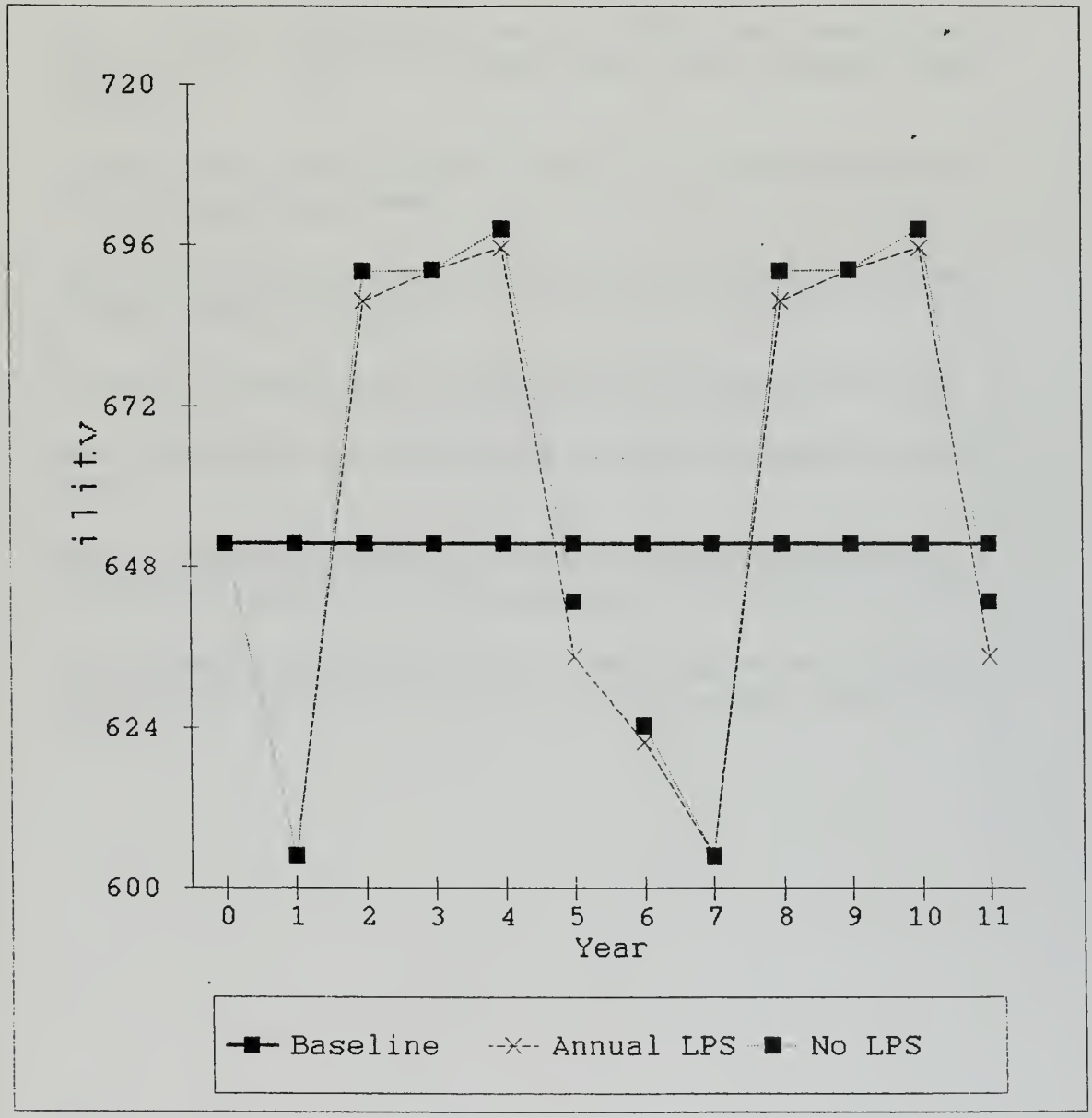
| 3 Year LPS (Off-Peak and Off-Trough)/Cyclical Exchange Rates (3 Year Cycle) | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| It | 1200 | 1200 | 1275 | 1200 | 1145 | 1106 | 1145 | 1200 | 1275 | 1200 | 1145 | 1106 | 1145 | 1200 | 1275 | 1200 | 1145 | 1106 | 1145 | 1200 | 1275 |
| Xc.t | 160 | 160 | 170 | 160 | 153 | 148 | 153 | 160 | 170 | 160 | 153 | 148 | 153 | 160 | 170 | 160 | 153 | 148 | 153 | 160 | 170 |
| Xl.t | 160 | 128 | 170 | 192 | 214 | 177 | 153 | 128 | 170 | 192 | 214 | 177 | 153 | 128 | 170 | 192 | 214 | 177 | 153 | 128 | 170 |
| Zc.t | 400 | 400 | 425 | 400 | 382 | 369 | 382 | 400 | 425 | 400 | 382 | 369 | 382 | 400 | 425 | 400 | 382 | 369 | 382 | 400 | 425 |
| LPSc | 0 5 | 0 5 | 0 5 | 0 45 | 0.45 | 0 45 | 0.5 | 0 5 | 0 5 | 0 45 | 0.45 | 0 45 | 0 5 | 0 5 | 0 5 | 0 45 | 0 45 | 0.45 | 0.5 | 0 5 | 0 5 |
| r.t | 100 | 80 | 100 | 120 | 140 | 120 | 100 | 80 | 100 | 120 | 140 | 120 | 100 | 80 | 100 | 120 | 140 | 120 | 100 | 80 | 100 |
| Pc.x.t | 2 5 | 2 5 | 2 5 | 2.5 | 2 5 | 2.5 | 2 5 | 2 5 | 2 5 | 2 5 | 2 5 | 2 5 | 2 5 | 2 5 | 2 5 | 2 5 | 2 5 | 2 5 | 2.5 | 2 5 | 2 5 |
| Pl.x.t' | 2 5 | 3 13 | 2 5 | 2.08 | 1 79 | 2.08 | 2 5 | 3 13 | 2 5 | 2 08 | 1 79 | 2 08 | 2 5 | 3 13 | 2.5 | 2 08 | 1.79 | 2 08 | 2 5 | 3 13 | 2.5 |
| Pc.z.t | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Rt | 1 | 1 06 | 1 | 0 95 | 0.92 | 0 95 | 1 | 1 06 | 1 | 0 95 | 0 92 | 0 95 | 1 | 1 06 | 1 | 0 95 | 0 92 | 0.95 | 1 | 1 06 | 1 |
| Ut | 651 | 605 | 692 | 692 | 696 | 638 | 622 | 605 | 692 | 692 | 696 | 638 | 622 | 605 | 692 | 692 | 696 | 638 | 622 | 605 | 692 |

| 3 Year LPS (On-Peak- delayed Implementation)/Cyclical Exchange Rates (3 Year Cycle) | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| It | 1200 | 1200 | 1287 | 1200 | 1142 | 1125 | 1156 | 1200 | 1287 | 1200 | 1142 | 1125 | 1156 | 1200 | 1287 | 1200 | 1142 | 1125 | 1156 | 1200 | 1287 |
| Xc.t | 160 | 160 | 172 | 160 | 152 | 150 | 154 | 160 | 172 | 160 | 152 | 150 | 154 | 160 | 172 | 160 | 152 | 150 | 154 | 160 | 172 |
| Xl.t | 160 | 128 | 172 | 192 | 213 | 180 | 154 | 128 | 172 | 192 | 213 | 180 | 154 | 128 | 172 | 192 | 213 | 180 | 154 | 128 | 172 |
| Zc.t | 400 | 400 | 429 | 400 | 381 | 375 | 385 | 400 | 429 | 400 | 381 | 375 | 385 | 400 | 429 | 400 | 381 | 375 | 385 | 400 | 429 |
| LPSc | 0 56 | 0 42 | 0.42 | 0 42 | 0 56 | 0 56 | 0 56 | 0 42 | 0 42 | 0 42 | 0 56 | 0 56 | 0 56 | 0 42 | 0.42 | 0 42 | 0.56 | 0.56 | 0.56 | 0 42 | 0 42 |
| r.t | 100 | 80 | 100 | 120 | 140 | 120 | 100 | 80 | 100 | 120 | 140 | 120 | 100 | 80 | 100 | 120 | 140 | 120 | 100 | 80 | 100 |
| Pc.x.t | 2 5 | 2 5 | 2 5 | 2 5 | 2 5 | 2 5 | 2 5 | 2 5 | 2 5 | 2 5 | 2 5 | 2 5 | 2 5 | 2 5 | 2 5 | 2 5 | 2 5 | 2 5 | 2 5 | 2 5 | 2 5 |
| Pl.x.t' | 2 5 | 3 13 | 2 5 | 2 08 | 1 79 | 2 08 | 2 5 | 3 13 | 2 5 | 2 08 | 1 79 | 2 08 | 2 5 | 3 13 | 2.5 | 2.08 | 1 79 | 2.08 | 2.5 | 3 13 | 2.5 |
| Pc.z.t | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Rt | 1 | 1.07 | 1 | 0.95 | 0.94 | 0.96 | 1 | 1 07 | 1 | 0 95 | 0.94 | 0 96 | 1 | 1 07 | 1 | 0 95 | 0.94 | 0.96 | 1 | 1.07 | 1 |
| Ut | 651 | 605 | 699 | 692 | 694 | 649 | 628 | 605 | 699 | 692 | 694 | 649 | 628 | 605 | 699 | 692 | 694 | 649 | 628 | 605 | 699 |

| No LPS/Cyclical Exchange Rates (3 Year Cycle) | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| It | 1200 | 1200 | 1275 | 1200 | 1150 | 1114 | 1150 | 1200 | 1275 | 1200 | 1150 | 1114 | 1150 | 1200 | 1275 | 1200 | 1150 | 1114 | 1150 | 1200 | 1275 |
| Xc.t | 160 | 160 | 170 | 160 | 153 | 149 | 153 | 160 | 170 | 160 | 153 | 149 | 153 | 160 | 170 | 160 | 153 | 149 | 153 | 160 | 170 |
| Xl.t | 160 | 128 | 170 | 192 | 215 | 178 | 153 | 128 | 170 | 192 | 215 | 178 | 153 | 128 | 170 | 192 | 215 | 178 | 153 | 128 | 170 |
| Zc.t | 400 | 400 | 425 | 400 | 383 | 371 | 383 | 400 | 425 | 400 | 383 | 371 | 383 | 400 | 425 | 400 | 383 | 371 | 383 | 400 | 425 |
| LPSc | 0 5 | 0 5 | 0.5 | 0 5 | 0 5 | 0.5 | 0 5 | 0 5 | 0 5 | 0 5 | 0 5 | 0 5 | 0 5 | 0.5 | 0 5 | 0.5 | 0 5 | 0.5 | 0 5 | 0 5 | 0.5 |
| r.t | 100 | 80 | 100 | 120 | 140 | 120 | 100 | 80 | 100 | 120 | 140 | 120 | 100 | 80 | 100 | 120 | 140 | 120 | 100 | 80 | 100 |
| Pc.x.t | 2 5 | 2 5 | 2.5 | 2.5 | 2.5 | 2.5 | 2 5 | 2 5 | 2 5 | 2.5 | 2.5 | 2 5 | 2 5 | 2 5 | 2.5 | 2 5 | 2.5 | 2.5 | 2 5 | 2 5 | 2 5 |
| Pl.x.t' | 2 5 | 3 13 | 2 5 | 2 08 | 1.79 | 2 08 | 2 5 | 3 13 | 2 5 | 2 08 | 1 79 | 2 08 | 2 5 | 3 13 | 2.5 | 2.08 | 1 79 | 2 08 | 2.5 | 3 13 | 2 5 |
| Pc.z.t | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Rt | 1 | 1 06 | 1 | 0.96 | 0 93 | 0 96 | 1 | 1 06 | 1 | 0 96 | 0 93 | 0 96 | 1 | 1 06 | 1 | 0 96 | 0.93 | 0.96 | 1 | 1.06 | 1 |
| Ut | 651 | 605 | 692 | 692 | 698 | 643 | 624 | 605 | 692 | 692 | 698 | 643 | 624 | 605 | 692 | 692 | 698 | 643 | 624 | 605 | 692 |

| Cyclical Exchange Rates (3 Year Cycle) | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| Baseline | 651 | 651 | 651 | 651 | 651 | 651 | 651 | 651 | 651 | 651 | 651 | 651 | 651 | 651 | 651 | 651 | 651 | 651 | 651 | 651 | 651 |
| Annual LPS | 651 | 605 | 688 | 692 | 696 | 635 | 622 | 605 | 688 | 692 | 696 | 635 | 622 | 605 | 688 | 692 | 696 | 635 | 622 | 605 | 688 |
| LPS @ Peak | 651 | 605 | 688 | 692 | 702 | 635 | 620 | 605 | 688 | 692 | 702 | 635 | 620 | 605 | 688 | 692 | 702 | 635 | 620 | 605 | 688 |
| LPS off Pea | 651 | 605 | 692 | 692 | 696 | 638 | 622 | 605 | 692 | 692 | 696 | 638 | 622 | 605 | 692 | 692 | 696 | 638 | 622 | 605 | 692 |
| Lagged LPS | 651 | 605 | 699 | 692 | 694 | 649 | 628 | 605 | 699 | 692 | 694 | 649 | 628 | 605 | 699 | 692 | 694 | 649 | 628 | 605 | 699 |
| No LPS | 651 | 605 | 692 | 692 | 698 | 643 | 624 | 605 | 692 | 692 | 698 | 643 | 624 | 605 | 692 | 692 | 698 | 643 | 624 | 605 | 692 |

**CYCLIC RATE OF EXCHANGE**



## LIST OF REFERENCES


1. Data for the Yen to Dollar exchange rate was provided by Commander U.S. Naval Forces, Japan. PDTATAC did not dispute these figures.

2. Author wishes to acknowledge that a majority of this chapter is based on the writings of Geoffrey A. Barrow, "Poor People in a Rich Land," *Challenge*, March - April 1994.

3. Quote taken from context: Geoffrey A. Barrow, " Poor People in a Rich Land," *Challenge*, March - April 1994.

4. Quote taken from context: Geoffrey A. Barrow, "Poor People in a Rich Land," *Challenge*, March - April 1994.

5. Data for LPS and computations provided by Mr. Len Pomeroy, PDTATAC.

6. Bottom Up Review of the COLA Program, General Accounting Office (GAO), 1989.

7. Information received from PDTATAC Information Paper prepared by Lt Gen Ebbesen, DASD (MPP) and Col Rhodes, Director, PDTATAC, 24 June 1995.

8. Edwin Mansfield, *Managerial Economics: Theory, Applications, and Case*, Second Edition, pp. 109-112, 512, W. W. Norton & Company, New York, NY, 1993.

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